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The Practical Air Quality Planning and Self-Evaluation Guide for Biomass Projects

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Abstract
The motivations of short-term and outsized profits lure many entrepreneurs to seek inclusion in the ever-growing biomass industry in Pennsylvania. This recent growth and the trend among those entrepreneurs that see their projects fail can be attributed mostly to the void of any useful guides on the biomass industry in Pennsylvania. This results in a lack of planning and confusing and contradictory information, which in turn results in a lack of useful information. In an effort to make more biomass projects successful, the research will result in a guide that will outline numerous environmental considerations for those entrepreneurs planning to start a business in the biomass industry. Often there is confusing and contradictory information about the biomass industry and exactly what the correct process is for obtaining all of the necessary air quality plan approvals and permitting needed for successful biomass projects. The primary focus of this guide will be to obtain a complete understanding of the various definitions of the biomass industry, outline the process and various steps of the air quality plan approval and permitting process and make recommendations for the implementation for successful projects. The criteria applied in evaluating the research included a practical review of the information obtained using professional working experience, a review and investigation of similar guides, textbooks and regulatory websites. The results of the research produced information about the biomass industry from all environmental media,but due to the longer time frames involved this guides main focus is in the air quality plan approval and permitting process. The results of the research produced information specifically in the areas of public support, funding opportunities, the relationships involving vendors, control devices, federal and state level particulate regulations, odor issues, opacity issues, fugitive emissions, stack testing, education, environmental permit management and pre-application meetings with the Pennsylvania Department of Environmental Protection (PA DEP). The results of the research also produced positive and negative results concerning why some biomass projects fail and why some succeed.

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THE PRACTICAL AIR QUALITY PLANNING AND SELF EVALUATION GUIDE FOR BIOMASS PROJECTS

Bill Dunagan

Spring 2011

Primary Reader: Maria Andrews
Secondary Reader: Ron Gray

DEDICATION

To my wife Venus, who taught me that you have to be a part of your community.

Without her love and support this would not have been possible.

ACKNOWLEDGMENT

Maria Andrews and Ron Gray have extended beyond the usual and ordinary, especially in size and scope. The countless edits, rewrites and suggestions offered throughout this project from both were truly epic and greatly appreciated.

ABSTRACT

THE PRACTICAL AIR QUALTY PLANNING AND SELF EVALUATION GUIDE FOR BIOMASS PROJECTS

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Maria Andrews

The motivations of short-term and outsized profits lure many entrepreneurs to seek inclusion in the ever-growing biomass industry in Pennsylvania. This recent growth and the trend among those entrepreneurs that see their projects fail can be attributed mostly to the void of any useful guides on the biomass industry in Pennsylvania. This results in a lack of planning and confusing and contradictory information, which in turn results in a lack of useful information. In an effort to make more biomass projects successful, the research will result in a guide that will outline numerous environmental considerations for those entrepreneurs planning to start a business in the biomass industry. Often there is confusing and contradictory information about the biomass industry and exactly what the correct process is for obtaining all of the necessary air quality plan approvals and permitting needed for successful biomass projects. The primary focus of this guide will be to obtain a complete understanding of the various definitions of the biomass industry, outline the process and various steps of the air quality plan approval and permitting process and make recommendations for the implementation for successful projects. The criteria applied in evaluating the research included a practical review of the information obtained using professional working experience, a review and investigation of similar guides, textbooks and regulatory websites. The results of the research produced information about the biomass industry from all environmental media,

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ABOUT THE AUTHOR

I am a longtime resident of Pennsylvania, who moved here in 1999 after being honorably discharged from the United States Army, to pursue my environmental education. I graduated from Edinboro State University with a BA in Environmental Studies, and shortly afterward became a public servant with the Pennsylvania Department of Environmental Protection. I began my career as an Air Quality Specialist based in the Warren District Office, and later transferred to the Meadville Regional Office.

The most rewarding part of my experiences in Northwestern Pennsylvania was working with small businesses. It was there that I began to understand the challenges that small business face in trying to comply with all of the State and Federal regulations.

After nearly four years of witnessing the successes and failures of hundreds of small businesses in one corner of Pennsylvania, I decided to pursue an opportunity to expand on the assistance I could provide, and joined the Pennsylvania Small Business Development Center's Environmental Management Assistance Program as an Environmental Consultant, specializing in Air Quality. In the three years since, I've assisted hundreds more small businesses throughout Pennsylvania that are facing similar challenges.

Equipped with this experience I have been concurrently pursuing a master's degree from the University of Pennsylvania in Environmental Studies, with a capstone thesis focus on the biomass industry from an air quality and small businesses perspective.

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CHAPTER ONE

INTRODUCTION

In an effort to make more biomass projects successful, this study will result in a guide, which will outline numerous environmental considerations for those planning to start a business in the biomass industry. Although the guide is not exhaustive, it can be used as an initial point of instruction that can assist entrepreneurs looking to start a biomass manufacturing business.

Entitled *The Practical Air Quality Planning and Self-Evaluation Guide for Biomass Projects*, this document will serve as a foundation for becoming more familiar with the numerous environmental considerations for a biomass project. Due to the often-lengthy permitting processes involved, this guide will focus mostly on the significance of planning ahead for air quality plan approvals and permits. This guide will discuss the process of preparing and submitting an air quality plan approval and permit application and why it is sometimes important to work with environmental consultants on some projects. Also discussed will be the areas of public support, funding opportunities, the relationships involving vendors, control devices, federal and state level particulate matter regulations, odor issues, opacity issues, fugitive emissions, stack testing, education, environmental permit management and pre-application meetings with the Pennsylvania Department of Environmental Protection (PA DEP). The guide will also discuss why some biomass projects fail, and present suggestions that will increase the chances of a more successful biomass project.

There is confusing and contradictory information about the biomass industry and exactly what the correct process is for obtaining all of the necessary environmental

permits and approvals needed for a successful project. This guide will serve as an important first step in providing the working knowledge that entrepreneurs will need to make biomass projects more successful. This guide will also serve as a problem-solving tool that can be used in the planning stages of biomass projects to ensure compliance with the federal, state and local environmental regulatory authorities. The operational knowledge needed to begin a biomass project, either by working with an environmental consultant or independently, will be obtained after working through this guide. The main design of this guide is to educate the reader with the basic knowledge needed to help make biomass projects more successful. Planning ahead, gaining public support and maintaining compliance are all important concepts to consider in the early stages of a biomass project. This guide is divided into many sections and may be used in a step-by-step manner or as a reference. The research questions being investigated are:

1. What is the biomass industry?
2. What are the air quality plan approval and permitting considerations for a biomass project?
3. Why plan ahead for air quality permitting?
4. What is the process of preparing a detailed air quality plan approval or permit for a biomass project?
5. Why do biomass projects fail?

THE BEGINNER

Biomass offers one of the most diverse forms of renewable energy due to the variety and availability of fuel sources that can be used. The biomass industry consists of the production, distribution and consumption of an organic form of renewable energy that primarily uses organic wastes, such as wood, corn or switch grass as the source of fuel. The list of potential biomass fuels is long and the type of permitting will in large part depend on the biomass fuel feedstock and the desired end product. Virtually all biomass fuel production industries will need some type of permitting at all levels of government (federal, state and local).

This diversity of biofuels, coupled with the motivation of short-term and outsized profits, lures many entrepreneurs to seek inclusion in the ever-growing biomass industry in Pennsylvania. The recent growth in the biomass industry in Pennsylvania and the trend among those entrepreneurs that see their projects fail can be attributed mostly to the void of any useful guides on the biomass industry in Pennsylvania. This results in a lack of planning and confusing and contradictory information, which in turn results in a lack of useful information.

However, there are some factors that make biofuels very attractive. Figure 1 shows that the growth in the consumption of biofuels in the United States has more than doubled in recent years. This growth has not gone unnoticed and recently was afforded greater executive level support. In his State of the Union speech on January 25th, 2011 President Barack Obama suggested that energy independence could be achieved; "w*ith more research and incentives, we can break our dependence on oil with biofuels"*. In order for this renewed interest to be successful in reducing America's dependency on

foreign sources of energy, one fundamental question will have to be answered, why bioenergy?

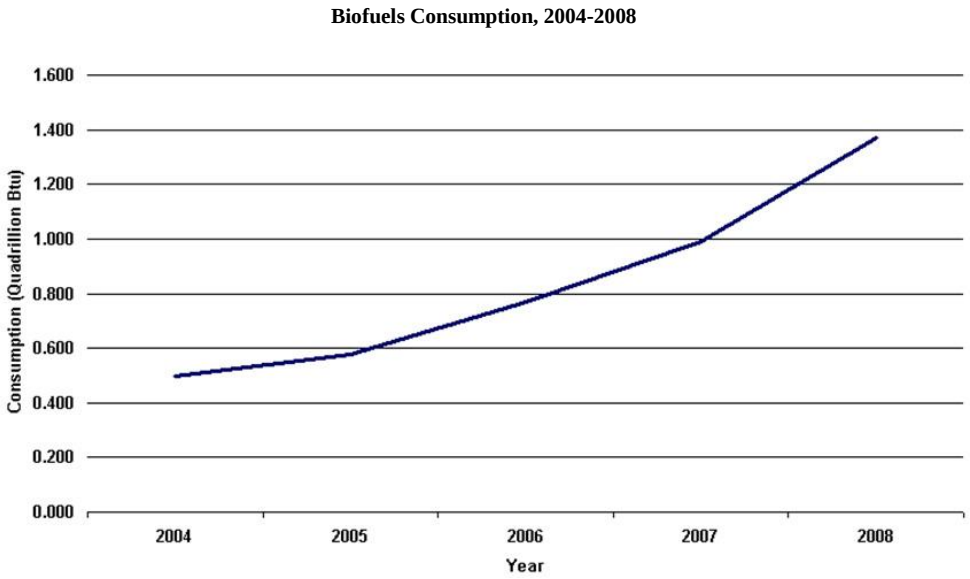

Figure 1

It is important to first understand the basics of what biomass is before this question can be answered. Dr. Daniel Ciolkosz, who is a Senior Extension Associate at the Pennsylvania State University Biomass Energy Center, presented a basic webinar that provided a good overview of the biomass industry that included technology, implementation considerations and funding opportunities for implementation at small businesses (2010). If Internet access is available, a web link is provided in the reference section of this guidebook where the webinar can be viewed. The following is also a brief summary.

The focus of the Biomass Energy Center is to coordinate and facilitate research and outreach across the university and to build teams to address the complete value chain of biomass energy systems. This includes improved production of biomass feed stocks, integration of biomass production into sustainable agro-systems, conversion of biomass

into energy and technology transfer to companies, state agencies, non-governmental organizations and citizens throughout the Commonwealth of Pennsylvania and beyond.

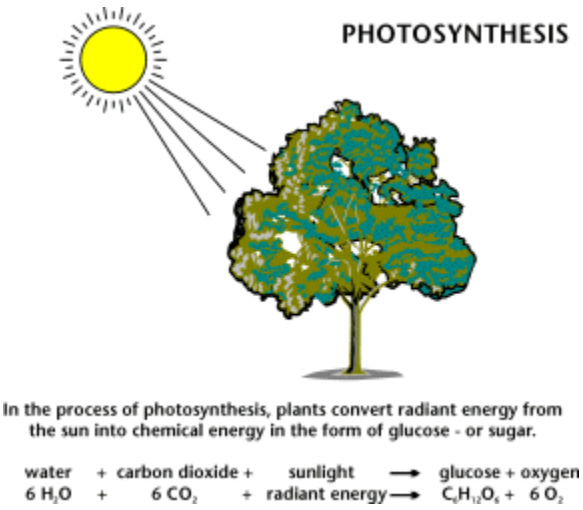

Figure 2

Ciolkosz begins at the most basic level, suggesting that biomass is anything that has recently died. A simple analysis of where our energy comes from offers some insight (Figure 2). The sun shines, the energy from the sun is stored in the plants and the plants grow (Photosynthesis). Biomass is considered a renewable energy source because we can always grow more plants. These plants die and are also eaten by animals, that in turn die and are covered and buried. Ultimately this organic matter turns into coal, natural gas, and oil. We extract these products and turn them into various forms of energy.

Biomass is simply going straight from the "growing plants" stage to turning those plants into bioenergy (Ciolkosz, 2010). For example, these solids, liquids and gases can be converted into fuel pellets to replace coal. Bioethanol, biodiesel, biogas and synthesis gas can replace natural gas (Figure 3). Ciolkosz suggests that it is important to keep in mind that just because we can do these things with biomass it doesn't necessarily mean that we should.

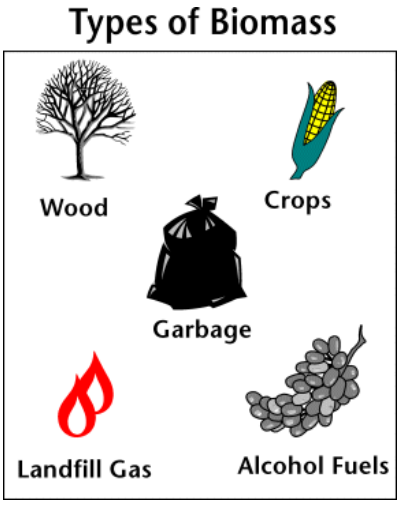

Figure 3

There are numerous social and political considerations, feedstock supply issues and

government incentives that make some biomass projects far more attractive than others.

The U.S. Energy Information Administration (EIA) offers an attractive example on the growth of the biomass industry in their 2008 report on Renewable Energy Consumption in the Nation's Energy Supply. EIA claims that between 2007 and 2008, renewable energy consumption grew 10% to 7.367 quadrillion Btu, while total U.S. energy consumption declined by 2% (due to the economic recession) and that as a result the renewable energy's share of the U.S. market increased just over 7%. Biomass energy in the industrial sector accounted for most of the balance in consumption. Figure 4 supports this and shows why the biomass industry is an attractive investment for many entrepreneurs.

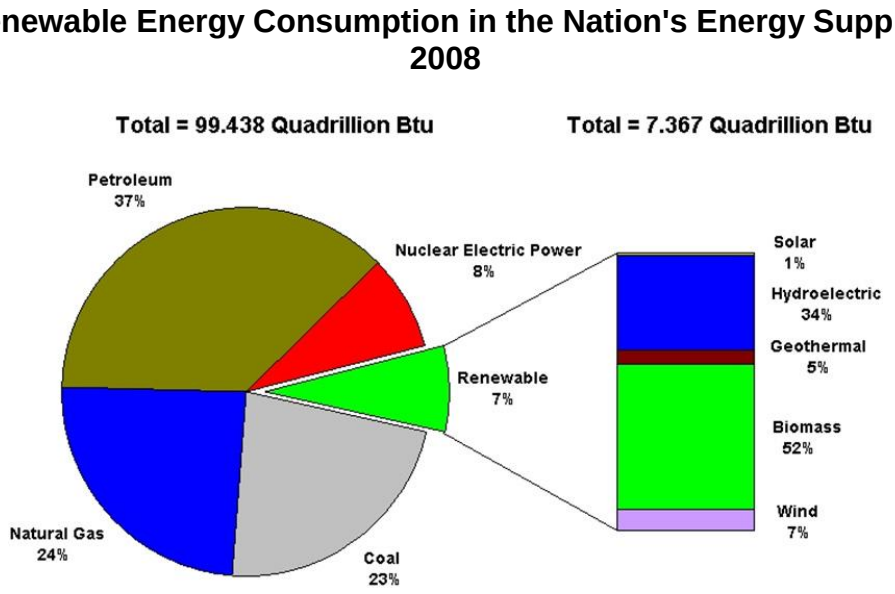

Figure 4

Although President Obama implies that America can break its dependence on foreign oil with biofuels, the true answer lies in understanding these very complex

social and political issues. The answers to energy independence will come through a series of trial and errors and this guidebook will serve to simplify the outcomes for the benefit of all stakeholders.

At the end of each section there is a simple checklist that can be used and will assist in answering the many questions regarding a biomass project. All of the checklists are also combined in Appendix A.

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Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
What is the proposed biomass feedstock and can it be acquired locally?	□	□	□	□	_____
Has the cost of transportation been considered?	□	□	□	□	_____
Will the biomass project involve supplying energy and if so, who will be the consumers?	□	□	□	□	_____
Other?	_____				

ENVIRONMENTAL JUSTICE

One area of a biomass project that must be considered is environmental justice. Environmental justice issues have been recognized for many years, but were brought to the public spotlight by President Clinton, on February 11th, 1994, with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations". The order's main goal is to achieve environmental protection for all communities. Although this sounds like a very straightforward goal to achieve oftentimes it is not because of the misconceptions that exist due mainly to confusing and contradictory information.

In Pennsylvania, the Department of Environmental Protections' (PADEP) Office of Environmental Advocate (OEA) works towards a similar goal and many others. Deciding on a site location for a biomass project could very well have major implications on the success of the project. The Environmental Justice Workgroup exists within the Office of Environmental Advocate. The workgroup produced a draft report in March 2001 that included a series of maps for Pennsylvania that show the combined minority and poverty data based on 1990 census data. The highlighted areas in Figure 5 indicate where combined minority populations are higher than 30% and where the population in poverty is higher than 20% in Pennsylvania.

Whether or not the chosen site is an environmental justice area can be preliminarily determined by reviewing the map in Figure 5. For more detailed information on a specific site, a review of one of the several regional maps from the Environmental Justice Workgroup draft report is the best place to start (Figure 6). After a

specific site is chosen, then an even more detailed analysis should be conducted using the most current census data available for the specific site.

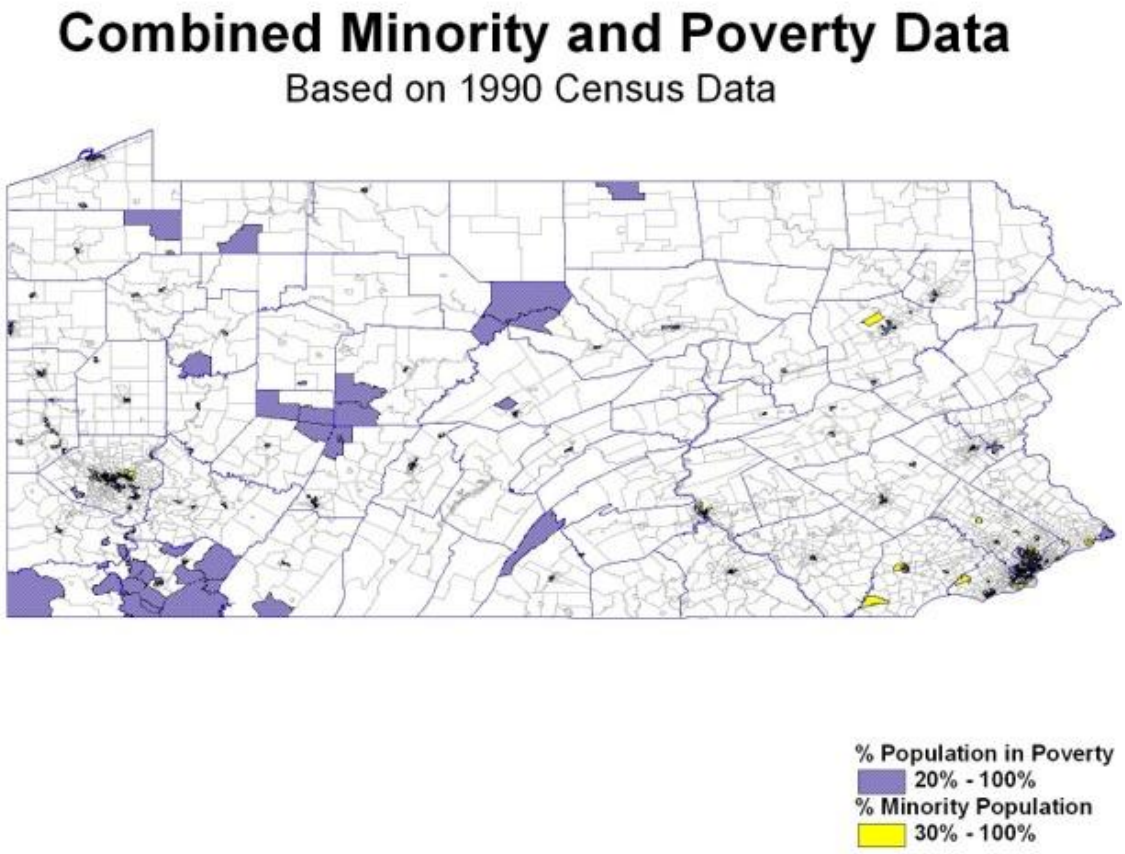


Figure 5

However, a general rule of thumb to consider for a site that could be an environmental justice area would be a community whose citizens are either 30% or more minority or 20% or more low-income within a ½ mile radius of a proposed project. Once the PA DEP has identified the site as an environmental justice area it will trigger an enhanced public participation process that can include additional meetings, which are meant to build relationships between communities, industry, and regulatory agencies. The incentive to build strong relationships with the surrounding community on a biomass project is success. There are examples of all sorts of projects that have failed because of

a lack of these relationships with the surrounding communities and which can be attributed mostly to confusing and contradictory information, which in turn results in a lack of useful information.

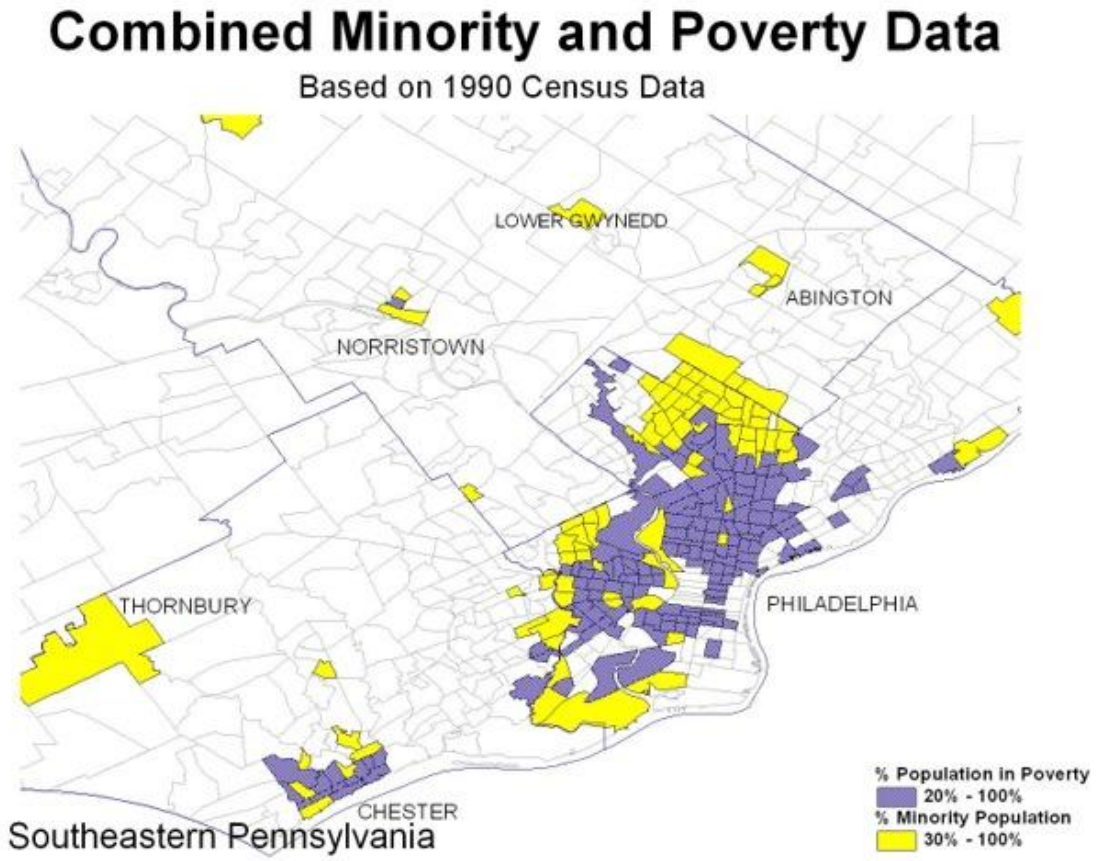


Figure 6

In Robert Bullard's book, *Dumping in Dixie* (2000) he explores these relationships. Bullard's research carried out in 1987-88, examines how community attitudes and socioeconomic characteristics influence activism and mobilization strategies of black residents who are confronted with the threat of environmental stressors (2000). He uses three data sources in his research: government documents and archival records; in-depth interviews with local opinion leaders; and household surveys (Bullard, 2000).

Gaining public support for any proposed projects that have the potential for adverse environmental consequences is a valuable lesson for all entrepreneurs. This holds especially true for the biomass industry due to ever-evolving technology and regulations. Bullard's methodology is supported by his research which includes case studies that are vivid and soundly researched and still apply today by providing the knowledge needed to have a productive discussion, not only with the regulated community but the general public, well before a project is started.

Whether the chosen site location is considered an environmental justice area or not should not limit the decision to use a similar methodology to Bullard's. Reviewing pertinent government documents like similar permits is a great place to start. A records review can be conducted at all PA DEP Regional offices and do usually require appointments. Early in the planning stages of the project there should be key meetings with local leaders, elected officials, local citizens, volunteer groups and environmental advocacy groups. Laying this foundation early in the planning stages will result in a more successful project.

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
Have similar permits for biomass projects been reviewed?	□	□	□	□	_____
Have local elected officials and other community leaders been contacted?	□	□	□	□	_____
Have any local citizens involved in volunteer groups or environmental advocacy groups been contacted?	□	□	□	□	_____
Other?	_____				

CORPORATE SOCIAL RESPONSIBILITY

The growing trend among large and small businesses to include environmental and social mechanisms to measure organizational success, along with the traditional range of economic values and criteria, has taken hold on virtually every level of our economy. John Elkington was one of the first to coin the phrase for triple bottom line (1994). This type of corporate social responsibility has caught on recently and goes by many names: financial, social and environmental; people, planet, profit; economic, ecological, social.

In *Green to Gold*, Esty (2006) examines businesses using these methods and outlines ways to develop a business through various means using his version of the best strategy to address corporate social responsibility called Eco-Advantage. Esty argues that the trend of corporate social responsibility and how to cut costs through eco-efficiency, eco-expense reduction, value chain eco-efficiency, eco-risk control, eco-design, eco-sales and marketing is the most successful way. Esty supports this by offering many dramatic case studies that show successes and failures and claims that by studying the mistakes previously made, such as "green washing", entrepreneurs could use this as a solid starting foundation for success.

The growing trend to use the "Triple Bottom Line" or TBL theory can be seen in many large businesses, but it is unclear as to what their motivations are and how they are similar to each other. It appears that oftentimes there are confusing definitions about the TBL theory and how exactly it is used. The primary focus of this section will be to obtain a complete understanding of the various definitions of the TBL theory and comparing them to the source of inspiration for using it, the process and various steps on

how it is applied and the implementation and current status of comparable definitions. The criteria to be applied in evaluating the TBL theory and the focus of defining what the triple bottom line is will include a practical review of the efficacy, accuracy and accessibility of the information obtained throughout the research. The objective is to attempt to identify what a triple bottom line is within these parameters and to make suggestions for improvement. A detailed investigation and review of the available literature was conducted, primarily to determine if accurate and useful information on the subject of the TBL theory is supplied. The information was compared to the source of inspiration for using it, the process and various steps on how it is applied and the implementation and current status of comparable definitions. The results have improved the definition and the decision-making abilities of those environmental leaders and entrepreneurs who use it. Cause for optimism is apparent with current and future leaders who understand the importance of operating a business as a medium for bringing together stakeholders and shareholders because it translates into a better "bottom line" for everyone.

The "bottom line" for a business deals exclusively with cost and profits. A new concept has recently emerged that adds to the "bottom line" of businesses. This relatively new concept termed the "Triple Bottom Line" presents a unique environmental dilemma for businesses. The growing trend to use the TBL theory can be seen in many large businesses, but it is unclear as to what their motivations are and how they are similar to each other. It appears that oftentimes there are confusing definitions about the TBL theory and how exactly it is used. The concept of the TBL theory is broad and narrowing the volumes of information available to only what is practical to respond to these concerns is provided in this section. Documenting this growing corporate trend by

providing limited, but accurate and useful information on the issue of the TBL theory to all of the stakeholders and shareholders is challenging but could offer insight into some of the recently created green jobs such as "Vice President for Sustainability", “Chief Environmental Officer” and other similar positions. Many corporations have already taken this step and have given some limited access by such officers, to top level or senior administration.

One of the first to fashion the phrase “triple bottom line” was John Elkington in 1994 and it was later expanded and articulated in his 1997 book; *Cannibals with Forks: the Triple Bottom Line of 21st Century Business*. The TBL theory involves three main areas; financial, social, and environmental. It is also known by other names such as “people, planet and profit” and “economic, ecological and social” and is becoming more of a trend in corporate thought. Some advocates of the TBL theory also refer to it as “cooperate social responsibility”, which implies a commitment to some form of TBL reporting.

Although there has been an impressive increase in this form of reporting, the initial efforts have been plagued by their lack of uniformity, consistency and comparability in the information presented. The main reason for this can be directly attributed to the various definitions of the TBL and different interpretations of the social costs.

Field implies in *Environmental Economics*, that social cost, in terms of full social cost accounting, means that the social costs are equal to the private cost plus the external (environmental) costs. How these social costs are interpreted is paramount to accurately defining the TBL and would offer uniformity, consistency and comparability.

The TBL theory goes beyond the traditional range of economic values and criteria that measure organizational success to include environmental and social mechanisms. This type of measurement usually involves a vice president of sustainability or similar person that evaluates the adverse and beneficial significance of the direct and indirect effects of a business's current or planned activities that determine its viability as a sustainable organization. This often takes the form of what a particular business feels is most significant and appropriate to its place in society, therefore not making it comparable to other businesses that might have a different set of measurements for what it feels is most relevant. For biomass projects, a "green" perception exists, but if the project is poorly planned the desired outcome of success would not be obtained. Public perception can work both for and against a biomass project.

Stakeholders and shareholders involved can interpret what the definition of the TBL theory is in many ways differently. There appear to be many conflicting motivations for the use of the TBL term, including exactly what should be measured or reported. This type of accounting is distinct from a traditional reporting framework and takes into account environmental and social performance in addition to financial performance. The concept of the TBL theory suggests that a business's responsibility lies with the stakeholders rather than the shareholders. Mish argues that accurately sensing and responding to the needs of distant stakeholders and selecting which stakeholder concerns to address, require finely tuned market intelligence and sense marketing.

For biomass projects this can lead to a perception of "green washing". This perception of "green washing" has made many weary of these newly created green jobs and positions and is intimately tied into how the TBL is defined. Some critics of the TBL

theory argue that to seek a solution some vice presidents of sustainability and those in environmentally related positions have resorted to classifying the TBL so that it fits into their businesses goals and objectives. If true, this fragmented approach would add to the weariness of the "green-washing" perception. The answer to providing limited, but accurate and useful information on the subject of the TBL theory and comparing it to the source of inspiration for using it, how it is applied and how comparable definitions stack up will challenge that perception and ultimately benefit all stakeholders and shareholders alike.

Practically all scholars refer back to John Elkington's expanded definition of sustainability as the basis of the TBL. Others like Manikas and Godfrey suggest in several articles that *Our Common Future* (World Commission on Economic Development, 1987, p.8) was the first place that truly described sustainable development as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". Schieg contends that this should be more of a voluntary action and that the concept of corporate social responsibility is best described as the voluntary contribution of the economy towards sustainable development beyond statutory requirements.

The significance of providing limited, but accurate and useful information on the issue of triple bottom line to all of the stakeholders and shareholders alike is challenging and cannot be overstated. The TBL theory has many conflicting definitions but all involve some sort of commonality with sustainability. The research has clearly shown that different motivations exist as to why some businesses use the TBL theory versus why other businesses do not. The definitions are somewhat comparable, but it really depends on the

motivation of the business using it. These differing motivations have led some businesses to unknowingly "green-wash" their operations in an attempt to fit in. While other businesses have detailed programs in place, are actively working on implementing those programs and have all virtually developed a set of metrics that only conform to the needs of their businesses. Very few businesses understand the cost-versus-benefits of the sustainability initiatives they implement. These cost-benefits, if applied correctly, will directly result in increased profits and sustainable jobs.

Cokins suggest that understanding the cost-versus-benefit ratio of sustainability initiatives will involve analytics similar to those used in performance management and that the better an organization understands the ratio, the better its financial performance will be. Actually implementing these changes to the way a business currently operates can also be misunderstood at all levels within a business. Johnson suggests that in order to be successful many questions have to be asked up front and answered, before implementing any changes. The why, what, where, how and implementation of these changes have to be impressed as establishing a business need. Without such, a forced change could have dire consequences.

The TBL can be analyzed from three different perspectives, *efficacy* or power to produce an effect, *accuracy* in the defined terms, and *accessibility* in terms of the information available. Any involved participant can use this comprehensive approach to make a more informed decision on how to use the TBL in their business operations, including biomass projects.

One important way by which to judge the TBL is its efficacy, or power to produce an effect. The provision that produced the first effect was creating the awareness in the

1990's. Since then, the TBL theory has been studied and used ever-increasingly in making business decisions. The power to produce an effect on businesses by using the TBL is immense from both a successful point of view and for failure if incorrectly applied. The efficacy of the TBL is strong and appears to be growing over time. Many large corporations have begun implementing some form of the TBL strategy and those in their value chain are sure to follow. The true efficacy of the TBL can only be measured over time, but if history is any indication of where corporate mindsets are headed, then the outlook is good for social and environmental well being.

Another important way by which to judge the TBL theory is the accuracy of the definition. Although similar, there exist many interpretations of the TBL and how it is defined. Nelson suggests that the common thread is what is valuable. Determining the accuracy of what is valuable could be accomplished by having one accurate definition that everyone understands. The difficult part in creating a one-for-all definition would be assessing what value one-person places on something versus what value another person places on that same thing. In terms of accuracy, it would be useful if there were variables built into the metrics used that considered the social and environmental aspects. Any proposed definition that does not accomplish placing value on the social and environmental aspects would only add to the many misinterpretations of the TBL.

Another important way to judge the TBL theory is how accessible is the information on the TBL theory. Simple Internet searches easily produce a plethora of information and therein lies the problem. Given the accessibility of the information available online on the subject of sustainability, this has inadvertently caused too many interpretations of how to apply or use the TBL theory. This over-access to information has led many

businesses to "green-wash" their operations in an effort to fit in with the current environmental trends. A clearinghouse of information that everyone could access would be a good place to start. Regulatory agencies in the United States could play a big role in bringing everyone to the table in this sense and could offer incentives to those who voluntarily participate. Access to a program of this type would have to be completely voluntary. Steps would need to be in place that prevented businesses from just simply paying for a certification or label. No "green-washing" allowed! Less "green-washing" would ultimately translate into improved consumer confidence, which would translate into better profits for businesses.

Improvements can be made from three different perspectives, *efficacy, accuracy* and *accessibility,* but there are many other areas that this guide did not discuss due to the complexity of the issues and given the time constraints. Graham understands the complexities involved:

> "*Measuring organization performance is difficult, especially when what has to be measured keeps changing. Sustainability concepts have dramatically widened the scope of measurement options and leading organizations are grappling with sustainability reporting, but there is no sign of consensus on a common reporting standard and the competing frameworks are impossibly complex.*" (2009).

Any set of metrics that accurately measure businesses TBL will undoubtedly continue to be refined over time. Once the threshold of consumer confidence exceeds the point of "green-washing", the value in the TBL can be realized by all. Elkington suggests for now it's a lot like trying to eat soup with a fork, it is difficult. Although some would consider this difficult for now, others claim there is hope for the future.

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
Does the biomass project have a strategy to address corporate social responsibility?	□	□	□	□	_____
What metrics will be used to validate the biomass project?	□	□	□	□	_____
Other?	_____				

CHAPTER TWO

CONCEPTS OF COMBUSTION

Obtaining a working knowledge of the concepts of combustion will offer a greater chance of success for those entrepreneurs looking to start a biomass project and will ensure the right choice was made concerning the air pollution control device. A recent course designed to introduce combustion-related pollution sources, principles and problems, design and operational parameters, fuels and pollution control devices discussed these choices (Doyle, 2004). Discussions on estimating the actual and potential air pollution emissions from combustion sources, reviewing applications for permits to construct combustion facilities, and developing recommendations to improve the performance of malfunctioning combustion equipment offered a way to interact and evaluate concerns in relation to the biomass industry. The course manual that was included was intended primarily for those with an engineering or scientific degree, or six months of equivalent work experience (Doyle, 2004).

The concepts of combustion and the related air pollution control devices discussed in this manual apply to most biomass combustion sources. For the purposes of this guidebook the focus of the concepts of combustion will be applied using biomass as the source of fuel using various sections of Combustion Source Evaluation (Doyle, 2004) that are most pertinent to biomass.

To begin, all of the common fuels are hydrocarbons, whose energy and fuel value are derived almost entirely from the oxidation of carbon but only the carbon gets oxidized the H oxidation number stays the same when reacting with oxygen to form water. Since all fuels are, or were, formed with the help of solar energy, biomass fuels represent stored

solar energy, which is released during combustion. Hydrocarbons are divided into two groups; solar energy and heat energy according to the timescale in which they participate in the energy and carbon cycle, represented in Figure 10 below (Doyle, 2004).

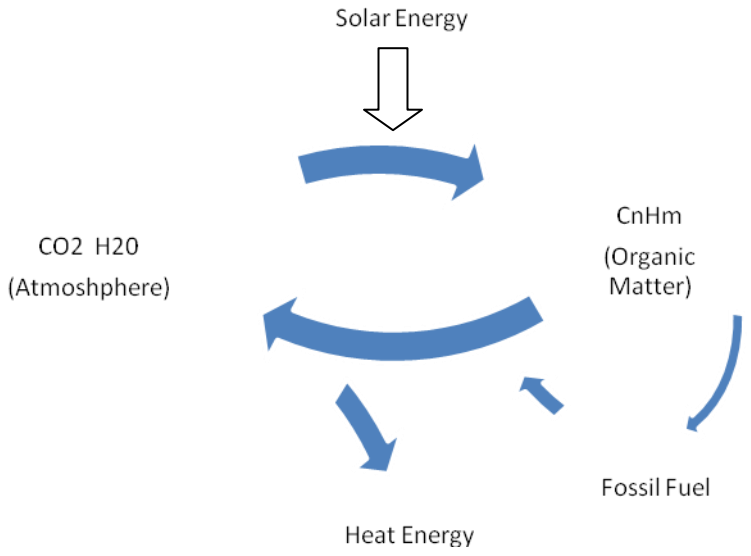


Figure 10

The organic matter or biomass hydrocarbons are all derived from living matter like wood and any other biological material on earth. Combustion sources and controls are developed around specific fuels and are usually related to the amount of ash in the fuel or the corrosive character of the resulting flue gas.

For biomass combustion sources where the dominant fuel is wood, characteristics to consider are moderate ash and high and variable water content, with a typical composition of CH_20. While wood is viewed as a clean renewable form of energy it often does not burn cleanly. When high moisture content is present the resulting emissions of visible smoke (opacity), CO and other organic compounds can cause concerns. This can only be assumed if the wood source is clean and free of contaminants.

Wood sources such as demolition debris, railroad ties and telephone poles have contamination that can generate hazardous particulate matter that would require a much higher level of control of emissions than financially possible for smaller biomass projects.

The amount of emissions produced by combustion sources is proportional to the amount of fuel burned and the type of contaminants in the fuel. The EPA's Compilation of Air Pollution Emission Factors (AP-42) is one place to look for the appropriate emission factors for a biomass project. AP-42 Chapter 1.2 *Wood Residue Combustion in Boilers* provides emission factors for PM using various control devices. The typical range for PM for a wood fire boiler controlled is 0.1 to 0.6 lb/mmbtu. AP-42 Chapter 1.2 also provides emission factors for SO_2, NOx and CO. EPA's F.I.R.E. data base also provides air emissions factors information. These emission factors will play a key role in estimating the emissions needed for an air quality plan approval or permit application for a biomass project.

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
What is the primary biomass fuel source?	□	□	□	□	_____
Are acceptable emission factors for the biomass project found in AP-42?	□	□	□	□	_____
Other?	_____				

WHAT IF?

Early in the planning stages, those seeking to start a business in the biomass industry must ask many "what if" questions. Unterberger (2005) suggests that the usefulness of any guidebook depends on the individual situation or problem and the ability to answer these "what if" questions. Questions such as what air pollution-related activities are regulated, which regulations or regulators are relevant, and what key air pollution regulatory requirements might apply to certain operations are all key questions (Unterberger, 2005). Building from this "what if" concept, this guidebook will answer similar questions applied more specifically to the subject of air quality and the biomass industry.

Determining and considering which air pollution-related activities are regulated is one on the most crucial steps in any biomass project and it could sway decisions significantly. Virtually all biomass combustion sources will be regulated for particulate matter (PM) depending on the size of the unit. There are some exemptions from acquiring a plan approval and/or permit for smaller units. The applicable exemptions for potential biomass projects can be found in PA DEP's Policy "Plan Approval and Operating Permit Exemptions" (Air Quality Permit Exemption Document # 275-2101-003, 7/26/2003) which defines determinations made regarding permitting exemptions as provided in the permitting regulations (http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-80104/275-2101-003.pdf). These exemptions and the respective regulations will be discussed in more detail in the section on Air Permitting. It is recommended to thoroughly explore all of the potential exemptions for a biomass project to evaluate whether a Request for Determination (RFD)

should be submitted to PA DEP. An RFD will tell whether or not a biomass project is required to obtain a air quality plan approval and/or permit.

Once the following section has been reviewed for potential issues, it is recommended to work with a consultant who can assist with air quality permit or plan approval applications and to coordinate a pre-application meeting with the appropriate PA DEP regional office to better understand all the applicable environmental regulatory requirements. Free and confidential assistance for small businesses that qualify will be discussed in more detail in the section on Regulatory Authority and Small Business Assistance.

If a biomass project does not qualify for an exemption, then an air quality plan approval and eventually, an operating permit will most likely be required. It is important to keep in mind that it will probably take a couple of weeks or longer to prepare a plan approval application for submittal to PA DEP and the time frame for receiving a signed plan approval from PA DEP is approximately 6 months, however it could take longer. Most aspects of the project will not be able to start without the proper authorization, which includes a signed plan approval.

However, there are two applicable programs to consider that are advantageous. The PA DEP Bureau of Air Quality implemented the optional Expedited Review Timeframes (ERT) program, which offers an opportunity to shave a month off of the six month timeframe. The program is very specific and requires a high level of involvement from the beginning. The ERT program requires a pre-application meeting and only guarantees either issuance of the requested authorization or a determination not to issue.

The other applicable program is the Money-Back Guarantee (MBG) program. The MBG program only guarantees that if an administrative completeness determination is not made within the specified timeframes, then a refund of the plan approval or permit application fees is granted. These programs enable the applicant and the PA DEP to work together to reduce the time necessary to review plan approval and/or permit applications and offer the potential for a faster review of a plan approval or permit application.

It is very important to note here that there are numerous environmental issues that should be considered when planning a biomass project. The following is not an exhaustive list, but it is a starting point to help launch a biomass project on the right track and planning ahead is one of the most important considerations.

Biomass Project Considerations

1. Plan Ahead: If the plan is to install a biomass burner with a rated capacity greater than 2.5 mmbtu/hr, a plan approval and/or operating permit from the PA DEP is needed. EMAP consultants can help to determine whether a plan approval and/or permit will be required. DEP regulations require the facility operator or owner to obtain all necessary permits and approvals before beginning construction. §25 PA Code 127.11 states, in part:

> *"a person may not cause or permit the construction or modification of an air contamination source…or the installation of an air cleaning device on an air contamination source, unless the construction, modification, reactivation, or installation has been approved by the Department".*

Failing to consider this will most likely result in a compliance and enforcement scenario that could subject the project's responsible parties to a substantial monetary penalty. This is one of the fastest ways to lose public support for a biomass project and is not recommended.

2. Air Quality Control Devices: Once a decision has been made on the stationary biomass source, the next step is to choose an appropriate air pollution control device. Some common air pollution control devices for the control of particulate matter (PM) are cyclones, multiclone and baghouses. This choice will be mostly driven by the applicable air pollution regulatory requirements and the costs involved with air pollution control devices. Oftentimes these costs are paramount to a successful biomass project. Extreme caution should be taken when purchasing used air pollution control equipment. It is recommended to do a complete engineering evaluation to see if prospective air pollution control device will meet the regulatory requirements. While a cyclone is a great start, it is only considered a "pre-conditioner" and usually has a high efficiency rating only for larger particulate matter and is not effective with smaller particulate matter like PM10 and PM2.5. An evaluation of the need for a secondary or "polishing" control device should be conducted. If needed, a baghouse can be used to control the smaller particulate matter. Exemptions exist for baghouses and cyclones but they have to be less than 5000cfm and it is oftentimes difficult to meet the regulatory PM standards.

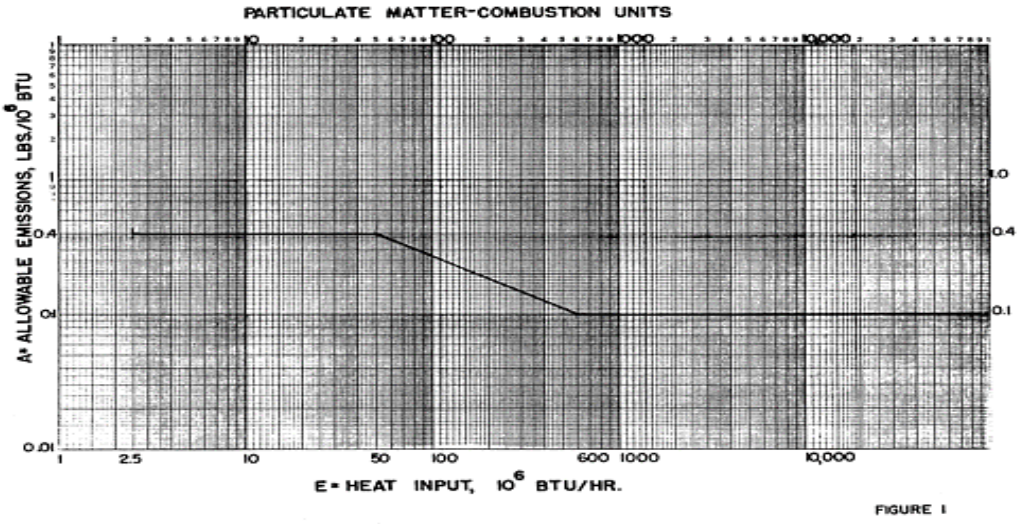
3. Vendors: Most air pollution control device vendors are familiar with whether their product is compliant in their state (if buying from out of state), but may not be familiar

with Pennsylvania regulations. Requesting all of the required technical information for a complete assessment, early in a biomass projects planning stages will minimize the risk of potential compliance issues for biomass projects. Although EMAP consultants cannot engineer or design a system for a biomass project, the consultants can assist with evaluating potential stationary biomass sources and air pollution control devices with regard to the Pennsylvania regulations.

4. <u>"Grain loading" standard:</u> In Pennsylvania, regardless of whether a biomass combustor needs a plan approval or permit there are still regulations that will apply. There are three different standards for particulate matter that are listed in §25 PA Code 123.11 for combustion units:

> *(a) A person may not permit the emission into the outdoor atmosphere of particulate matter from a combustion unit in excess of the following:*
>
> *(1) The rate of 0.4 pound per million Btu of heat input, when the heat input to the combustion unit in millions of Btus per hour is greater than 2.5 but less than 50.*
>
> *(2) The rate determined by the following formula:*
>
> $A = 3.6E^{-0.56}$ *where:*
>
> *A = Allowable emissions in pounds per million Btus of heat input,* ***and***
>
> *E = Heat input to the combustion unit in millions of Btus per hour, when E is equal to or greater than 50 but less than 600.*
>
> *(3) The rate of 0.1 pound per million Btu of heat input when the heat input to the combustion unit in millions of Btus per hour is equal to or greater than 600.*

(b) Allowable emissions under subsection (a) are graphically indicated in Appendix A. (The provisions of this § 123.111 adopted September 10, 1971, effective September 11, 1971, 1 Pa.B. 1804; amended March 3, 1972, effective March 20, 1972, 2 Pa.B. 383.)



(Figure 7: This appendix cited in 25 Pa. Code §123.11 (relating to combustion units).

The table above shows that the standard is 0.04 gr/dscf for some operations, but Best Available Technology (BAT) for some sources is 0.02 gr/dscf. Both standards will likely apply depending on the source (the biomass combustion source and its associated control device).

5. Odor issues: Because of inherent odor issues with using some biomass feedstocks, the PA DEP may require a plan for odor management. This could involve storing the material under a roof, only storing a week's worth of raw material on-site, or something different. Most likely a biomass project will not be permitted to store large, unchecked amounts of raw material outside because of the potential for odors. §25 PA Code 123.31 outlines the limitations:

(a) Limitations are as follows:

(1) If control of malodorous air contaminants is required under subsection (b), emissions shall be incinerated at a minimum of 1200°F for at least 0.3 second prior to their emission into the outdoor atmosphere.

(2) Techniques other than incineration may be used to control malodorous air contaminants if such techniques are equivalent to or better than the required incineration in terms of control of the odor emissions and are approved in writing by the Department.

(b) A person may not permit the emission into the outdoor atmosphere of any malodorous air contaminants from any source, in such a manner that the malodors are detectable outside the property of the person on whose land the source is being operated.

(c) The prohibition in subsection (b) does not apply to odor emissions arising from the production of agricultural commodities in their unmanufactured state on the premises of the farm operation.

(The provisions of this § 123.31 adopted September 10, 1971, effective September 11,1971, 1 Pa.B. 1804; amended March 3, 1972, effective March 20, 1972, 2 Pa.B. 383; amended August 12, 1977, effective August 29, 1977, 7 Pa.B. 2251; amended August 12, 1983, effective August 13, 1983, 13 Pa.B. 2478. Immediately preceding text appears at serial page (75541)).

6. Opacity issues: Consistent percent moisture of supply of raw material is the easiest way to avoid opacity issues. The best way to ensure consistent percent moisture is to

know where the raw material supply is coming from because ultimately the owner of the unit is responsible for its proper operation. Correct operation of the unit can also help mitigate moisture variations, but can be labor intensive and could require someone to manage the unit full time. §25 PA Code 123.41 outlines the opacity limitations:

> *A person may not permit the emission into the outdoor atmosphere of visible air contaminants in such a manner that the opacity of the emission is either of the following:*
>
> *(1) Equal to or greater than 20% for a period or periods aggregating more than 3 minutes in any 1 hour.*
>
> *(2) Equal to or greater than 60% at any time.*

(The provisions of this § 123.41 adopted September 10, 1971, effective September 11, 1971, 1 Pa.B. 1804; amended March 3, 1972, effective March 20, 1972, 2 Pa.B. 383)

7. Fugitive emissions: PA DEP will require a plan to address fugitive emissions from all transfer points, i.e., silos, roadways, buildings, conveyors, etc. The prohibition of certain fugitive emissions can be found in §25 PA Code 123.1:

> *(a) No person may permit the emission into the outdoor atmosphere of a fugitive air contaminant from a source other than the following:*
>
> *(1) Construction or demolition of buildings or structures*
>
> *(2) Grading, paving and maintenance of roads and streets.*
>
> *(3) Use of roads and streets. Emissions from material in or on trucks, railroad cars and other vehicular equipment are not considered as emissions from use of roads and streets.*

(4) Clearing of land.

(5) Stockpiling of materials.

(6) Open burning operations.

(7) Blasting in open pit mines. Emissions from drilling are not considered as emissions from blasting.

(8) Coke oven batteries, provided the fugitive air contaminants emitted from any coke oven battery comply with the standards for visible fugitive emissions in § § 123.44 and 129.15 (relating to limitations of visible fugitive air contaminants from operation of any coke oven battery; and coke pushing operations).

(9) Sources and classes of sources other than those identified in paragraphs (1)—(8), for which the operator has obtained a determination from the Department that fugitive emissions from the source, after appropriate control, meet the following requirements:

(i) The emissions are of minor significance with respect to causing air pollution.

(ii) The emissions are not preventing or interfering with the attainment or maintenance of an ambient air quality standard.

(b) An application form for requesting a determination under either subsection (a) (9) or §129.15(c) is available from the Department. In reviewing these applications, the Department may require the applicant to supply information including, but not limited to, a description of proposed control measures, characteristics of emissions, quantity of emissions and ambient air quality data and analysis showing the impact of the source on ambient air quality. The applicant is required to demonstrate that the requirements of subsections (a)(9)

and (c) and § 123.2 (relating to fugitive particulate matter) or of the requirements of § 129.15(c) have been satisfied. Upon such demonstration, the Department will issue a determination, in writing, either as an operating permit condition, for those sources subject to permit requirements under the act, or as an order containing appropriate conditions and limitations.

(c) A person responsible for any source specified in subsections (a)(1)—(7) or (9) shall take all reasonable actions to prevent particulate matter from becoming airborne. These actions include, but not be limited to, the following:

(1) Use, where possible, of water or chemicals for control of dust in the demolition of buildings or structures, construction operations, the grading of roads or the clearing of land.

(2) Application of asphalt, oil, water or suitable chemicals on dirt roads, material stockpiles and other surfaces which may give rise to airborne dusts.

(3) Paving and maintenance of roadways.

(4) Prompt removal of earth or other material from paved streets onto which earth or other material has been transported by trucking or earth moving equipment, erosion by water, or other means.

(d) The requirements contained in subsection (a) and § 123.2 do not apply to fugitive emissions arising from the production of agricultural commodities in their unmanufactured state on the premises of the farm operation.

(The provisions of this § 123.1 adopted September 10, 1971, effective September 11, 1971, 1 Pa.B. 1804; amended March 3, 1972, effective March 20, 1972, 2 Pa.B. 383;

amended August 12, 1977, effective August 29, 1977, 7 Pa.B. 2251. Immediately preceding text appears at serial pages (4620) and (24610)).

8. Stack testing: Most biomass projects should be prepared to conduct a stack test to prove to the PA DEP that the PM emissions are compliant with the regulations. Stack testing can sometimes be moderated by acquiring manufacturer guarantees on the emissions from the proposed stationary sources and air pollution control devices. The PA DEP will make this determination on a case by case basis. If stack testing is required, it can cost thousands of dollars.

9. Education and Permit management: Once the construction and installation phase of a biomass project is completed, preparations should be made to keep daily records, complete periodic reports, and comply with any other monitoring, recordkeeping or reporting requirements as part of the issued air quality plan approval and/or permits. Plan approvals and permits are "living documents" that will require continual management, either by the facility's operator, by hiring additional staff or working with a consultant. Setting up an individualized management strategy in-house will minimize the project's cost. For qualifying small businesses, EMAP consultants can assist with setting up an individualized management strategy so a few different individuals within a biomass project can perform the reporting and record keeping requirements of the air quality plan approval or permit.

10. Regulators: One common question with biomass projects is which regulatory agencies are involved. In most cases it will be a joint effort of local, state and federal agencies. The physical location of the biomass project will determine which regulatory agency will be the most active with permitting, compliance and enforcement activities. Though, this is not always the case, so it is necessary to seek the appropriate approvals from all levels (local, state, & federal).

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
Have sufficient plans been made to acquire all necessary permits and approvals from PA DEP?	□	□	□	□	_____
Has the necessary technical information been acquired from all vendors for evaluation in relation to the Pennsylvania regulations?	□	□	□	□	_____
Has an air quality control device been chosen and will it meet the "grain loading" standard?	□	□	□	□	_____
Is there a plan to manage any potential odor issues?	□	□	□	□	_____
Is there a plan to manage any potential opacity issues?	□	□	□	□	_____
Is there a plan to manage any potential fugitive emissions?	□	□	□	□	_____
Are finances available if required to conduct a stack test?	□	□	□	□	_____
Is there a plan to manage the air quality plan approval or permit once issued?	□	□	□	□	_____
What air pollution-related activities are regulated for the project?	□	□	□	□	_____
Which regulations or regulators are relevant, and what key air pollution regulatory requirements might apply to certain operations?	□	□	□	□	_____
Has the physical site location been chosen?	□	□	□	□	_____
Other?	_____				

AIR PERMITTING

Navigating the paths of air quality permitting can seem like a daunting task for anyone. The timeframes that must be planned for with air quality permitting can mean the difference between a successful project and one that is not. There are source and industry-specific regulations that will most likely apply to the biomass industry. The procedures used to calculate emissions, assess appropriate air pollution controls, prepare an air quality permit application or determine regulatory applicability are all standard procedures regardless of the industry. The authors of *Pennsylvania Air Permitting Guide* (Carroll & Narsh, 2005) offer a concise overview on all these subjects and more.

There are various levels of permitting and exemptions to consider for a biomass project. As discussed in the "What if?" section, if the plan is to install a biomass burner with a rated capacity greater than 2.5 mmbtu/hr, an air quality plan approval and/or operating permit from the PA DEP is needed and EMAP consultants can help make this determination. If no plan approval or permit is required, it is recommended to submit a request for determination (RFD) for the biomass project so PA DEP can provide a formal determination for the non need of a permit. This offers peace of mind that will ensure that the biomass project is in compliance and potential enforcement situations can be avoided.

The best place to start once a decision has been made that an air quality plan approval or permit is needed is to fill out the General Information Form (GIF). This form begins with basic information about the client, site, facility and project. Most importantly, the GIF also asks for information on land use and coordination. Most of these sections will not apply to a biomass project but there are a few key areas to consider

for example, earth disturbance, storm water, wastewater, waste treatment, wetland impacts, underground storage tanks (UST's) and beneficial use of biosolids. The GIF should be filled out and completed first. The PA DEP will likely require, at a minimum, that the GIF be filled out and submitted prior to a pre-application meeting to ensure that representatives from the various programs (air, waste, water, etc) are available to answer questions and discuss the biomass project.

The pre-application meeting is required as part of the PA DEP's Expedited Review Timeframes (ERT) program or the Money-Back Guarantee (MBG) program, including proposed biomass projects. The PA DEP Bureau of Air Quality implemented the optional Expedited Review Timeframes alternative in addition to the standard existing Money-Back Guarantee Program timeframes to enable the applicant and the Bureau to work together to reduce the time necessary to review plan approval applications. These programs are rigorous and require that both the applicant and PA DEP act within specified timeframes on requests for information. However, these programs do offer the potential for a faster review of an air quality plan approval or permit application.

The next step in air quality permitting is to fill out the Air Pollution Control Act Compliance Review Form. This form requires basic information about the form of management of the applicant, information about any current or past plan approvals or operating permits issued to the applicant in the last five years and a listing of any previous compliance issues.

There are many different specific plan approval applications that are all dependent on what the air contamination source and air cleaning device is. For biomass projects,

most likely the specific air quality plan approval application to be used will either be for "Processes" or "Combustion Units".

Given the variability of most biomass projects a good place to begin is with the process narrative. This will assist the permit engineer who is reviewing the application conceptually understand the biomass project.

The next section that will be key in a successful biomass air quality plan approval application is estimating emissions. Emission factors from AP-42 are the generally accepted industry standard. An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant (e.g., kilograms of particulate emitted per megagram of coal burned). Such factors facilitate estimation of emissions from various sources of air pollution. In most cases, these factors are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category (i.e., a population average) (http://www.epa.gov/ttnchie1/ap42/ 2/27/2011). The general equation for emissions estimation is:

E = A x EF x (1-ER/100)

where:

E = emissions;

A = activity rate;

EF = emission factor, and

ER =overall emission reduction efficiency, %

The two important emission estimates that should be performed are the pre-control potential to emit and the "grain loading" standard. First, emission estimates for pre-control emission should be prepared. The Potential to Emit (PTE) will be important to consider early because it will essentially determine what level of permitting will be required for a biomass project. PTE is the maximum capacity of a source to emit a pollutant under its physical and operational design, assuming continual operation for a calendar year. Estimating PTE with and without various control devices will help guide a biomass project in terms of the level of permitting and control devices required.

The "Grain loading" standard previously discussed will apply in Pennsylvania, regardless of whether a biomass combustor needs an air quality plan approval or permit. Emission estimate examples for PTE, control and no control and for the grain loading standards are located in Appendix D.

Municipal Notifications are a required step when applying for an air quality plan approval or permit. Biomass projects are required to notify the municipality and county where the air pollution source will be located. The notification has to clearly describe the source involved and should provide for a 30-day comment period that begins when the municipality or the county receives the notice. Proof of this step in the air quality plan approval process can be achieved by sending the notices via certified mail and including a copy of the return receipt (green card) in the completed application package. Depending on the type and complexity of the air quality plan approval, the biomass project might also be subject to a notice in the Pennsylvania Bulletin, a public meeting or public hearing. It is recommended to work with PA DEP to ensure the correct language

and citations are used but the following is an example text for a municipal notification letters for an air quality plan approval:

> *To Whom It May Concern:*
>
> *Please find this letter to serve as notification required by 25 Pa Code 127.43a. The 30 day comment period begins upon your receipt of this letter.*
>
> *(Name of the biomass company) is applying to the PA Department of Environmental Protection for the applicable air quality permits required for a proposed manufacture and sale of biomass pellets. The operation is located at our manufacturing site in (Name of Township). Emissions from this source will be below major facility levels.*
>
> *If you require additional information about our operation, please feel free to contact me.*

This brief primer on air permitting and the associated documents and forms that are required to be submitted for a biomass project can all be found online at PA DEP's website (http://www.dep.state.pa.us/dep/deputate/airwaste/aq/permits/plan.htm 2/27/2011).

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
Is the biomass combustion unit rated greater than 2.5 mmbtu/hr?	□	□	□	□	_____
Have emission estimates been prepared?	□	□	□	□	_____
Is an air quality plan approval application complete?	□	□	□	□	_____
Has general information form (GIF) been completed?	□	□	□	□	_____
Has a compliance review form been completed?	□	□	□	□	_____
Has a municipal notification been prepared and if so, is there proof?	□	□	□	□	_____
Other?	_____				

CHECKLISTS AND WORKSHEETS

Environmental management plans are essential to virtually every business. EPA's Small Business Division suggests that by using checklists and worksheets a business can be systematically reviewed in relation to their current and future operations (U.S. EPA, 2003). This guide offers numerous examples of reports, notifications and permit record-keeping as well as outlines for training programs that could be used in the biomass industry as a framework to develop similar checklists and worksheets specific to the industry. This basic guide serves as a starting place for those individuals with little or no experience with environmental management plans.

At the end of each section a Biomass Project Checklist was provided. These checklists have been combined in Appendix A for convenience and to serve as the foundation for documenting a biomass project's environmental management plan.

For biomass projects this will involve designating multiple people to share in and support the environmental responsibilities. By establishing who is responsible for what, the environmental management plan helps to increase accountability within the company and motivates employees to take more personal responsibility for environmental management because the tasks are well defined and not overwhelming (U.S. EPA, 2003).

Having various levels of involvement is essential before, during and after regulatory inspections. This ensures that when the biomass facility is inspected everyone knows what's going on and the inspector will be impressed by the proactive nature of the facility. This will also serve to minimize any potential compliance issues. Although normally unannounced, planning for regulatory inspections is important. Most regulatory inspections will involve a pre-inspection meeting, a facility tour to check the air pollution

sources and control devices, including recording any operating parameters, a records review and finally a post inspection meeting to review the inspectors findings.

A good environmental management plan will take some time to develop and to have it organized. Some examples of items that should be tracked for a biomass project and some typical operating parameters required in air quality plan approval and permits include:

- Raw material throughputs and finished product outputs
- Maintenance records for all air pollution sources and control devices
- Calculations for regulated pollutants emitted
- Measuring the pressure differential across the fabric collector or baghouse and recording this reading either daily, weekly or monthly and any other control equipment or device operational parameters that can demonstrate compliance
- Keeping on hand a sufficient quantity of spare fabric collector filters for the fabric collectors associated with the air pollution source in order to be able to immediately replace any filters requiring replacement due to deterioration resulting from routine operation of the source(s) and baghouse(s)
- Proof that any applicable control devices and monitoring equipment are properly installed, calibrated, operated and maintained with the vendor's specifications
- Any performance evaluations
- Any energy efficiency audit data

- Source tune-up data and documentation
- Any CAM or other continuous compliance plans
- Any applicable source testing requirements, including required testing data
- Anything else required by an issued plan approval and permit document

While most air quality plan approvals require maintaining records for a minimum of two years, a facility operating permit usually requires maintaining records for 5 years (if practical it is recommended to keep records as long as possible). Knowing which records and reports are required and which employee(s) are responsible for maintaining them will result in a more successful biomass project. The SBO, EMAP consultants and PA DEP can all play a role in assisting with the development of a useful environmental management plan if involved early in the planning stages of a biomass project. Beginning an environmental management plan is as simple as working with these resources to assist with air quality permit or plan approval applications and to coordinate a pre-application meeting with the appropriate PA DEP regional office to gain a better understanding of the applicable environmental regulatory requirements.

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
Has multiple people been designated to share in and support the environmental responsibilities for the biomass project?	□	□	□	□	_____
Have the proper records and operating parameters to be monitored been identified?	□	□	□	□	_____
Have all of the checklists in this guide been completed?	□	□	□	□	_____
Other?	_____				

CHAPTER THREE

REGULATORY AUTHORITIY AND SMALL BUISNESS ASSISTANCE

Pennsylvania Department of Environmental Protection

The Pennsylvania Department of Environmental Protection (PA DEP) is responsible for administering Pennsylvania's environmental laws and regulations. The PA DEP's mission is to protect Pennsylvania's air, land and water from pollution and to provide for the health and safety of its citizens through a cleaner environment. The PA DEP partners with individuals, organizations, governments and businesses to prevent pollution and restore natural resources (PA DEP, 2010).

Relevant topics for biomass startup projects such as public participation, environmental justice, funding, grants and air quality permitting are accessible through PA DEP's website and are summarized throughout this guidebook. For most biomass projects the PA DEP will take the lead with these issues and be the most active with the permitting, compliance and enforcement activities of the project. Determining the correct state regional office or approved local air quality programs can be somewhat confusing but it essentially depends on the physical site location of the biomass project.

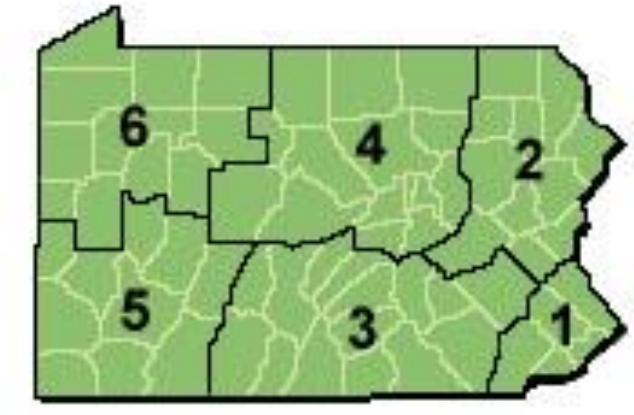


Figure 8

There are six PA DEP regions throughout the Commonwealth of Pennsylvania (Figure 8). There are also two separate local air quality

programs that are fully approved under Pennsylvania's Air Pollution Control Act for Allegheny and Philadelphia counties. The air pollution control regulations are in most cases the same or similar, but separate from the rest of the state. Contact information for all of the PA DEP regions, Philadelphia County (Air Management Services) and Allegheny County (Allegheny County Health Department) are provided in Appendix B. It is important to note that federal air pollution regulations apply to all facilities in the U.S.

Setting up a pre-application meeting with the correct state regional office or approved local air quality programs is a crucial step for biomass projects. A pre-application meeting will serve numerous purposes. First, it will serve as an opportunity for biomass startups to discuss the project in conceptual terms, potentially avoiding any compliance or enforcement issues. Next it will allow for an exchange of information for both the regulators and the biomass startup to discuss potential issues with topics other than air quality (waste, land, & water). Finally, it will provide an opportunity to build working relationships through open dialogue will those regulators who will be overseeing a biomass projects permitting process. However, before setting up a pre-application meeting, it is recommended to review all of the information in this guidebook and complete the appropriate checklists. This will allow for a more productive meeting and provide an opportunity to meet directly with those individuals working on the biomass project's permit.

Small Business Assistance

Amendments to Section 507 of the 1990 Federal Clean Air Act require each state to establish a Small Business Stationary Source Technical and Environmental

Compliance Assistance Program (also known as "507 Program," and/or "Small Business Environmental Assistance Program") to help small businesses comply with air quality regulations. Section 507(d) charges the EPA Small Business Ombudsman with monitoring and reporting on the overall effectiveness of the program.

These state programs are composed of three components: a small business compliance assistance program (currently Small Business Environmental Assistance Program or SBEAP), a Small Business Ombudsman (SBO), and a Compliance Advisory Panel (CAP). These components work together and are monitored by the US EPA Asbestos and Small Business Ombudsman (EPA ASBO). In some states these functions are handled within the state regulatory agency. Pennsylvania outsources this function through a third party contractor. It is important to note that in Pennsylvania the three resources available to assist small businesses (SBO, EMAP and the CAC) are mandated by Sections 7.7 and 7.8 of the Pennsylvania Air Pollution Control Act of 1959 as amended, 1992 and go well beyond what is required in the Amendments to Section 507 of the 1990 Federal Clean Air Act.

Small Business Environmental Assistance Program (SBEAP)

In 2003, the Pennsylvania Department of Environmental Protection approached the Pennsylvania Small Business Development Center (PA SBDC) with a partnership proposal through which the Environmental Management Assistance Program (EMAP) would serve as the Commonwealth's Small Business Environmental Assistance Program. This partnership was finalized in 2004 and EMAP enhanced its staffing expertise to

provide in-depth air quality compliance assistance, added a toll-free environmental help desk (1- 877.ask.emap) and established an easy-to-find website at www.askemap.org.

The Environmental Management Assistance Program is a specialized consulting service of the Pennsylvania Small Business Development Centers. EMAP provides free and confidential environmental assistance to small businesses in Pennsylvania. EMAP services are strictly confidential and are provided at no charge and are funded by grants through the Commonwealth of Pennsylvania. Working with an environmental consultant is an important step in any proposed project and this is especially true with the biomass industry. The services offered by the EMAP consultants are unique not only because they are free and confidential, but also because of the consultant's years of experience in private industry and government.

Entrepreneurs tend to have limited funds and often cannot afford private paid consultants. EMAP consultants offer small businesses the tools needed to educate themselves to better understand and comply with regulatory requirements, improve their operations by reducing energy use and waste and provide basic and in-depth assistance on biomass projects by acting as a liaison to the regulatory authorities, assisting with complex calculations on emission estimates, determining regulatory applicability and preparation of permit applications (EMAP, 2010).

Small Business Ombudsman (SBO)

In Pennsylvania, the office of the Small Business Ombudsman (SBO) serves as the confidential primary point of contact for small businesses on issues relating to compliance with the Pennsylvania Air Pollution Control Act and the Federal Clean Air

Act (PA APCA Section 7.9). By law, the SBO cannot reveal the identity of any small business in circumstances specifically relating to their economic and compliance without the small businesses permission, but may do so in other circumstances. For instance, when the SBO reports the number and types of small business assisted with plan approvals, permits and RFD's. Also the SBO can report on the difficulties experienced by small businesses in complying with the PA APCA or the federal CAA. The SBO also reports annually to the Governor and General Assembly on the effectiveness of the Small Business Stationary Source Technical and Environmental Compliance Assistance Program and any other issues relating to the impact of the Federal Clean Air Act implementation on small businesses in the Commonwealth.

The Small Business Act authorizes the Small Business Administration to define small business by regulation. The SBA's small business definitions are codified at 13 CFR 121.201. The SBA defines small business by category of business using North American Industrial Classification System (NAICS). For example, in the case of manufacturing, the SBA generally defines small business as a business having 500 employees or fewer. For many types of manufacturing, however, the SBA's size standards define small business as a business having up to 750, 1000 or 1500 employees, depending on the particular type of business. In the case of agriculture; mining; and gas and sanitary services, the SBA size standards generally define small business with respect to annual receipts (from $0.5 million for crops to $25 million for certain types of pipelines). The SBA definition of a small business applies to a firm's parent company and all affiliates as a single entity (http://www.epa.gov/sbrefa/business.htm and http://www.sba.gov/content/guide-size-standards March, 2011).

Primarily, the SBO serves as the advocate and spokesperson for small businesses community within PA DEP and assists small business with complying with environmental regulations. The Pennsylvania SBO also can provide educational opportunities and information on financing programs that are relevant to biomass projects. This includes biomass projects seeking financial assistance to implement pollution prevention practices by realizing potential cost savings of pollution prevention versus pollution control.

The SBO provides compliance assistance and pollution prevention pamphlets and fact sheets for small businesses and reviews pending regulations that could have an impact on small businesses. The SBO also investigates complaints from small businesses about PA DEP and reports annually to the Governor and the U.S. EPA regarding the performance of the Small Business Assistance Program.

Compliance Advisory Panel (CAP)

In Pennsylvania the Small Business Assistance Program Compliance Advisory Panel goes by a slightly different name but fulfills the federal mandate as outlined in Section 507 of the Clean Air Act Amendments of 1990. In Pennsylvania the name of the CAP is the Small Business Assistance Program Compliance Advisory Committee (CAC) The purpose of the Committee is to advise the Small Business Assistance Program and Ombudsman, to review proposed and existing regulations as they affect small businesses, to assure such regulations are written in understandable, clear laymen's terms, and to advise the Department of the small business perspective on air quality issues and the

program is administered by the Department's Bureau of Air Quality (CAC By-Laws 4/28/1999).

There are eleven members of the CAP, four of which are appointed by the Governor of Pennsylvania; one of which is a small business owner and three of which are not small business owners. Additionally each house of the Pennsylvania Legislature appoints two Committee members, one from the majority party and one from the minority party for a total of four appointees. The remaining three Committee members are the Small Business Ombudsman or Designee as provided for in Act 174 of 1996, the Department of Environmental Protection Secretary or Designee, and the Department of Economic and Community Development Secretary or Designee. Appointed members serve a term of four years and each member has one vote in Committee matters (CAC 4/28/1999).

Knowing and utilizing these available resources that are outlined in this section will result in a more successful biomass project. It is recommended to contact the SBO, EMAP and appropriate PA DEP regional office early in the planning stages of a biomass project.

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
Is it known in which PA DEP Region the biomass project will be located?	□	□	□	□	_____
Has the Small Business Ombudsman's Office been contacted for assistance?	□	□	□	□	_____
Has EMAP been contacted for assistance?	□	□	□	□	_____
Have preparations been made for a pre-application meeting with PA DEP?	□	□	□	□	_____
Other?	_____				

THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AND THE COMBINED HEAT AND POWER PARTNERSHIP

At the federal level, the United States Environmental Protection Agency (EPA) is set up similar to most state environmental regulatory agencies. In the case of the EPA, regions encompass many states as noted in Figure 9. Contact information for all ten EPA regions is located in Appendix C. Biomass projects that are physically located in the State of Pennsylvania are part of EPA's Mid-Atlantic Region 3, with offices located in Philadelphia, PA. Region 3 also serves the District of Columbia, Maryland, Virginia and West Virginia. While most small business biomass entrepreneurs might think there is not a need to explore the applicability of the federal level regulations, it is recommended to contact the appropriate EPA regional office after reviewing this section.

The U.S. Environmental Protection Agency (EPA) has a mission to protect human health and to safeguard the natural environment (air, water and land) upon which life depends. The EPA's website offers more information on in-depth technical definitions, reviews of regulatory applicability, potential sources of funding and contacts for the particular regions. These subjects will play a key part in operating a successful biomass project (U. S. EPA, 2010 www.epa.gov). The EPA has many different departments and partnerships for all

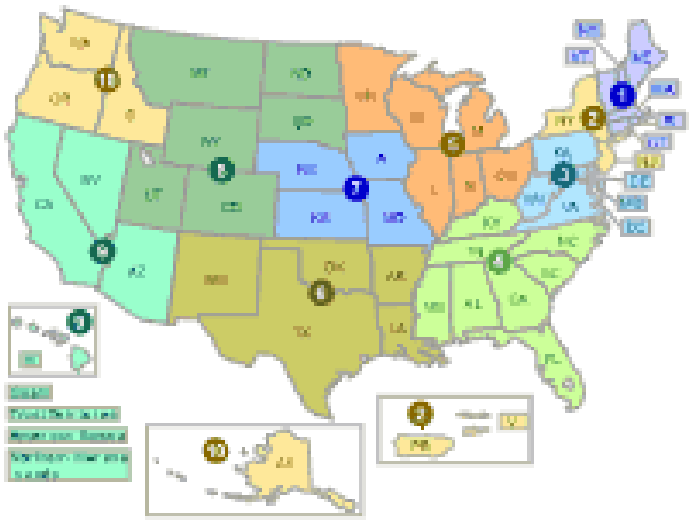


Figure 9

environmental media. One of those partnerships is the Combined Heat and Power (CHP) partnership, a voluntary program that seeks to reduce the environmental impact of power generation by promoting the use of CHP. CHP is an efficient, clean, and reliable approach to generating power and thermal energy from a single source. CHP can increase operational efficiency and decrease energy costs, while reducing the emissions of greenhouse gases which contribute to global climate change. The CHP Partnership works with energy users, the CHP industry, state and local governments and other stakeholders to support the development of new projects and promote their energy, environmental and economic benefits. The partnership provides resources about CHP technologies, incentives, emission profiles and other information. The CHP partnership offers one of the most comprehensive overviews of the biomass industry and begins with some basic first steps and considerations, then moves on to evaluate biomass resources, preparation, conversion technologies, system costs and performance profiles by using appropriate figures and tables that enhance the reader's ability to understand the material (Dhungel-Naik, 2007 http://www.epa.gov/chp/documents/biomass_chp_catalog.pdf).

Some emission requirements that may apply directly to the operators of biomass facilities beyond those imposed by the state or local air quality permitting program are based on construction, modification, reactivation or installation of the source. Federal New Source Performance Standards (NSPS), Maximum Achievable Control Technology (MACT) and National Emission Standards for Hazardous Air Pollutants (NESHAP) apply directly to categories of emission sources and typically establish emission limitations for specified criteria pollutants, regardless as to whether those limits have yet to be explicitly incorporated into a permit.

These emission limits are based on “best adequately demonstrated technology”. For example, limits on SO2, NOx and PM are in terms of pounds emitted per million Btu’s (lb/mmbtu) of heat input and are specified for “Industrial-Commercial-Institutional Steam Generating Units” that have a heat input capacity exceeding 100 million BTU’s per hour (Unterberger, 2005).

This regulation and other potentially applicable requirements for a biomass project are located in the Code of Federal Regulations, Title 40, Protection of the Environment, Part 60D through Dc, Standards for Performance for New Stationary Sources (NSPS) and outline the applicability provisions that should be considered for a biomass project (http://www.access.gpo.gov/nara/cfr/waisidx_10/40cfrv6_10.html). Biomass projects located in non-attainment areas would also have a special set of applicable regulatory requirements called Lowest Achievable Emission Rate (LAER).

Given the complexities of some biomass systems, it is recommended to work with the resources outlined in the previous chapter (SBO & EMAP) in order to obtain a better understanding of the potential NSPS applicability as it applies to a specific biomass project and to also assist in facilitating meetings with the approved state or local program to discuss permits and requirements, and with EPA Region III to discuss CHP.

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
Has EPA's Mid-Atlantic Regional Office been contacted for assistance?	□	□	□	□	_____
Has the Combined Heat and Power partnership been contacted for assistance?	□	□	□	□	_____
Does the NSPS standards apply to the biomass project?	□	□	□	□	_____
Will the biomass combustion unit have a heat input capacity exceeding 100 MMBTU/hr?	□	□	□	□	_____
Other?	_____				

CHAPTER FOUR

EMERGING REGULATIONS

Air pollution has been around for centuries in some form or another. England's King Edward I (reigned 1239-1307) offered some of the harshest penalties ever imposed to protect air quality, proclaiming that anyone caught using coal would be put to death (http://www.portal.state.pa.us/portal/server.pt/community/trails_of_history/4287/museum_of_anthracite_mining_%28ph%29/472646 4/2/2011). Although death is no longer a penalty imposed in today's society for using coal, over time the regulations governing air pollution have grown, driven in part by the advent of larger and more complicated sources of air pollution. The complicated and diverse air quality regulations of today were also driven in large part by the public's demand for them (Vallero, 2008).

Given the vast diversity of issues involving air pollution regulations and technology surrounding the biomass industry, it is essential to have a comprehensive multidisciplinary approach when making decisions about air pollution (Vallero, 2008). This is especially true for any proposed biomass projects that have the potential for adverse environmental consequences. Vallero offers numerous sections throughout his book that the technical reader can use for a quick reference guide for the science behind biomass energy and the regulations that might apply. Ciolkosz also offers insight on proposed particulate matter emission regulations that the U.S. EPA is now considering that could have an unfavorable affect on the growth of the biomass industry (https://breeze.psu.edu/p21767299/).

On February 21, 2011, EPA established practical and protective Clean Air Act emissions standards for large and small boilers. Additionally, EPA established standards

for incinerators that burn solid waste and sewage sludge. These standards cover more than 200,000 boilers and incinerators that emit harmful air pollution, including mercury, cadmium, and particle pollution (http://www.epa.gov/airquality/combustion/ 4/2/2011). Four sources are targeted by the new rules:

1. Boilers at large sources of air toxics ("major sources")
2. Boilers at small sources of air toxics ("area sources")
3. Incinerators that burn solid waste at industrial and commercial facilities (CISWI)
4. Incinerators that burn sewage sludge at wastewater treatment facilities (SSI).

EPA has also issued a final rule that defines "solid waste", which is necessary to determine whether a facility has to meet a boiler standard or an incinerator standard. In order to determine which of the two rules that cover boilers & process heaters apply, an assessment of the biomass project should be made to establish whether the air pollution source is classified as a boiler or process heater. Boilers burn fuel to produce steam that is used for heat or electricity. Process heaters heat raw or intermediate materials during an industrial process.

Early in the planning stages of a biomass project an assessment should be made about whether or not biomass is a good choice of fuel stock. This new rule covers other fuels besides biomass and careful considerations should be given when choosing the fuel stock and size of burner(s), regardless of whether it is biomass, in order to determine this rule's applicability. It is recommended to contact one of the various resources previously outlined to assist with determining applicability with site specific information for a

biomass project. The new EPA rules issue two standards covering boilers and process heaters at major sources of air toxics and boilers at area sources of air toxics, and both are summarized below, including emissions limits. The following section may be used as a quick reference for planning purposes.

Requirements for boilers and process heaters at major sources of air toxics:

- A major source is a facility that emits or has the potential to emit 10 or more tons per year (tpy) of any single air toxic or 25 tpy or more of any combination of air toxics
- The major source rule is expected to apply to about 13,800 boilers located at 1,600 facilities, primarily larger industrial sources such as refineries, chemical and manufacturing plants, pulp and paper mills
- The rule also includes boilers at some larger commercial and institutional facilities, such as shopping malls and universities
- More than 80% of large boilers are gas-fired and will only require an annual tune-up rather than meet an emission standard.
- 15 subcategories are identified based on design; specific requirements are established for each subcategory
- Standards vary slightly for existing units vs. new units

Boiler MACT – Final Subcategories

- Solid fuel
- Pulverized coal units
- Coal-fired stokers

- Coal-fired fluidized bed combustion units
- Biomass-fired stokers
- Biomass-fired fluidized bed combustion units
- Biomass-fired Dutch Ovens/Suspension burners
- Biomass-fired fuel cells
- Biomass-fired hybrid suspension/grate units
- Liquid fuel-fired units
- Liquid fuel-fired units located in non-continental States and territories
- Gas 1 (Natural gas/refinery gas)
- Gas 2 (other gases)
- Metal processing furnaces (natural gas-fired)
- Limited Use

Requirements for existing large boilers (>=10mm/BTU)

Clean gas *(natural gas, refinery gas, or process gas as clean as natural gas)*

- Annual tune-up
- No numeric emission limits
- 1-time energy assessment
- Solid fuel (coal or biomass)
- Numeric emission limits for 5 pollutants *mercury, dioxin, particulate matter (PM), hydrogen chloride (HCl), carbon monoxide (CO)*

Oil

- Numeric emission limits for 5 pollutants

  mercury, dioxin, particulate matter (PM), hydrogen chloride (HCl), carbon monoxide (CO)

- One-time energy assessment

Process gas that is not "clean" gas

- Numeric emission limits for 5 pollutants

  mercury, dioxin, particulate matter (PM), hydrogen chloride (HCl), carbon monoxide (CO)

- One-time energy assessment

Limited Use

- Tune-up every other year
- One-time energy assessment
- No numeric emission limits

<u>Requirements for new large boilers (>=10mm/BTU)</u>

Clean gas *(natural gas, refinery gas, or process gas as clean as natural gas)*

- Annual tune-up
- No numeric emission limits

Solid fuel (coal or biomass)

- Numeric emission limits for 5 pollutants *mercury, dioxin, particulate matter (PM), hydrogen chloride (HCl), carbon monoxide (CO)*

Oil

- Numeric emission limits for 5 pollutants

  mercury, dioxin, particulate matter (PM), hydrogen chloride (HCl), carbon monoxide (CO)

Process gas that is not "clean" gas

- Numeric emission limits for 5 pollutants

  mercury, dioxin, particulate matter (PM), hydrogen chloride (HCl), carbon monoxide (CO)

Limited Use

- Tune-up every other year
- No numeric emission limits

<u>Requirements for existing small boilers (<10mm/BTU)</u>

- No numeric emission limits
- Gas, solid fuel, oil, or limited use
- Tune-up every other year
- One-time energy assessment

<u>Requirements for new small boilers (<10mm/BTU)</u>

- No numeric emission limits
- Gas, solid fuel, oil, or limited use
- Tune-up every other year
- No numeric emission limits

While most biomass projects will not be considered major sources, it is highly recommended to perform emission estimates on the proposed source to determine applicability. A quick reference of the emission limits for major source boilers, including proposed and final emission limits and subcategories is provided in Appendix E. For smaller biomass sources the following will apply:

Boilers at area sources of air toxics

- An area source facility emits or has the potential to emit less than 10 tons per year (tpy) of any single air toxic and less than 25 tpy of any combination of air toxics
- The area-source rule is expected to apply to about 187,000 boilers located primarily at commercial facilities (e.g., hotels, office buildings, restaurants) and institutional facilities (e.g., schools, hospitals, prisons)
- The rule does NOT apply to boilers that are gas-fired (approximately 1.3 million units, or 87% of all area source boilers)
- Most units that are covered by this rule will be required to conduct a tune-up every other year and will not have to install pollution control equipment.
- Subcategories are based on boiler type
- Standards vary slightly for existing units vs. new units

Requirements for existing large boilers (>=10mm/BTU)

Gas (all types)

- No requirements
- Not covered by rule

Coal

- Numeric emission limits for 2 pollutants *mercury, carbon monoxide (CO)*
- One-time energy assessment

Biomass, Oil

- Tune-up every other year
- 1-time energy assessment
- No numeric emission limits

Requirements for new large boilers (>=10mm/BTU)

Gas (all types)

- No requirements
- Not covered by rule

Coal

- Numeric emission limits for 3 pollutants *mercury, carbon monoxide (CO), particulate matter (PM)*

Biomass, Oil

- Numeric emission limit for 1 pollutant *particulate matter (PM)*
- Tune-up every other year

Requirements for existing small boilers (<10mm/BTU)

Gas (all types)

- No requirements
- Not covered by rule

Coal, Biomass, Oil

- Tune-up every other year
- No numeric emission limits

Requirements for new small boilers (<10mm/BTU)

Gas (all types)

- No requirements
- Not covered by rule

Coal, Biomass, Oil

- Tune-up every other year
- No numeric emission limits

A quick reference of the emission limits for major source boilers, including proposed and final emission limits and subcategories is provided in Appendix F. The new EPA rule also issued two rules that cover incinerators that burn waste including those that sometimes use the heat for heat energy or steam. These are unlikely to apply to a biomass project but are provided for reference:

Commercial and Industrial Solid Waste Incinerators (CISWI)

- Number of units subject to this rule: 88
- Commercial and industrial facilities that burn solid waste
- Includes all size sources – no major and area source distinction
- 4 subcategories based on type of incinerator

Sewage Sludge Incineration (SSI)

- Number of units subject to this rule: 204
- 155 of these 204 units already meet the emission limits established in this rule
- Incinerators or combustion devices that burn dewatered sewage sludge, typically at wastewater treatment facilities designed to treat domestic sewage sludge
- Includes all size sources – no major and area source distinction
- 2 subcategories based on type of incinerator
- Units incinerating sludge at other types of facilities (e.g., commercial, industrial, and institutional) will be covered under different air pollution standards

Incinerator rules: Compliance requirements

- Incinerators burn waste to dispose of it. Some recover energy. EPA has established emissions standards for commercial and industrial solid waste incinerators (CISWI) and sewage sludge incinerators (SSI).
- Solid waste incinerators**:** There are 88 solid waste incinerators that burn waste at commercial or industrial facilities. These standards will reduce emissions of harmful pollutants including mercury, lead, cadmium, nitrogen dioxide and particle pollution.
- Sewage sludge incinerators**:** There are more than 200 sewage sludge incinerators across the country. These standards will reduce emissions of harmful pollutants including mercury, lead, cadmium, and hydrogen chloride.

Boiler and incinerator regulations are closely related because similar units may be considered boilers or incinerators based on whether or not they burn solid waste

materials. EPA is also finalizing which non-hazardous secondary materials would be considered solid waste and which would be considered fuel. This distinction would determine whether a material can be burned in a boiler or whether it must be burned in an incinerator (http://www.epa.gov/epawaste/nonhaz/define/index.htm 4/2/2011).

These standards were required by the federal court to be issued no later than February 21, 2011. EPA received approximately 4,800 public comments during the comment period and has made some significant changes based on this and a review of additional data (http://www.epa.gov/airquality/combustion/actions.html 4/2/2011). According to the EPA, the final standards achieve significant health benefits while being more practical and less costly to implement.

In addition, the EPA is initiating a reconsideration process for certain aspects of the two boiler rules and the Commercial, Industrial Solid Waste Incinerator (CISWI) rule (http://www.epa.gov/airquality/combustion/ 4/2/2011). The EPA will be accepting comments on specific elements of the rule, including any provisions that are proposed to be modified or added after more fully evaluating the data and comments already received. The EPA has indicated they will evaluate any stakeholder petitions for reconsideration. Existing sources will not have to comply with the standards for at least three years and as part of the reconsideration of the rules, stakeholders who make a compelling case may request an extension of that deadline.

Greenhouse Gases

On January 2, 2011, air quality permitting requirements began for large GHG emitting industries that are planning to build new facilities or make major modifications

to existing ones. These facilities must obtain air quality permits and implement energy efficiency measures or, where available, cost-effective technology to reduce their GHG emissions. This includes the nation's largest GHG emitters, such as power plants and refineries. Emissions from small sources, such as farms and restaurants, are not covered by these GHG permitting requirements (http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/4369c709163915b485257816005971bb!OpenDocument 4/2/2011).

Another new rulemaking that is scheduled to be completed by July 2011 that affects biomass projects includes EPA's greenhouse gas (GHG) waiver for biomass projects. This three year deferment of GHG permitting requirements for carbon dioxide (CO2) emissions from biomass-fired and other biogenic sources will undoubtedly relieve some of the regulatory burden on biomass projects. The EPA is using this time to seek further independent scientific analysis of this complex issue and then plan to develop a rulemaking on how these emissions should be treated in determining whether a Clean Air Act permit is required. This is encouraging news for the biomass industry and is supported by the EPA. "*We are working to find a way forward that is scientifically sound and manageable for both producers and consumers of biomass energy. In the coming years we will develop a commonsense approach that protects our environment and encourages the use of clean energy*," said EPA Administrator Lisa P. Jackson, "*Renewable, homegrown power sources are essential to our energy future, and an important step to cutting the pollution responsible for climate change."* The EPA summarizes this in a recent news release:

"EPA is deferring permitting requirements for CO2 emissions from biomass-fired and other biogenic sources for three years in an effort to seek input on critical scientific issues from its partners within the federal government and from outside scientists who have relevant expertise. EPA will also further consider the more than 7,000 comments it received from its July 2010 Call for Information, including comments noting that burning certain types of biomass may emit the same amount of CO2 emissions that would be emitted if they were not burned as fuel, while others may result in a net increase in CO2 emissions. Before the end of the three-year period, the agency intends to issue a second rulemaking that determines how these emissions should be treated or counted under GHG permitting requirements. CO2 emissions from biomass-fired and other biogenic sources are generated during the combustion or decomposition of biologically based material. Sources covered by this decision would include facilities that emit CO2 as a result of burning forest or agricultural products for energy, wastewater treatment and livestock management facilities, landfills and fermentation processes for ethanol production. The agency will also issue guidance shortly that will provide a basis that state or local permitting authorities may use to conclude that the use of biomass as fuel is the best available control technology for GHG emissions until the agency can complete an action on the three-year deferral in July. In a separate but related letter, EPA is notifying the National Alliance of Forest Owners that it will grant its petition to reconsider the portion of the May 2010 tailoring rule that addresses the same issue." http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/4369c709163915b485257816005971bb!OpenDocument 4/2/2011).

SUMMARY AND CONCLUSIONS

The motivations of short-term and outsized profits lure many entrepreneurs to seek inclusion in the ever-growing biomass industry in Pennsylvania. This recent growth and the trend among those entrepreneurs that see their projects fail can be attributed mostly to the void of any useful guides on the biomass industry in Pennsylvania. This guide has resulted in clarifying air quality information on the biomass industry that was previously confusing and contradictory, including the process for preparing a detailed air quality plan approval or permit. This guide has also resulted in providing useful information on the importance of planning ahead and potential failure for biomass projects. The sources and the underlying concepts presented throughout this guide are meant to offer many entrepreneurs the tools needed for successful long-term profits. In an effort to make more biomass projects successful, this guide has outlined numerous environmental considerations for those entrepreneurs planning to start a business in the biomass industry and made recommendations for successful biomass projects. The recommendations concerning the areas of public support, funding opportunities, the relationships involving vendors, control devices, federal and state level particulate regulations, odor issues, opacity issues, fugitive emissions, stack testing, education, environmental permit management and pre-application meetings with the PA DEP, if applied correctly, will result in a more successful biomass project. This opinion is supported by positive and negative results concerning why some biomass projects fail and why some succeed. The basis of the research for this guide was derived from professional working experience, a review and investigation of similar guides, textbooks and regulatory websites.

DEFINITION OF TERMS

BACT

Best Available Control Technology--An emissions limitation (including a visible emissions standard) based on the maximum degree of reduction for each regulated NSR pollutant which would be emitted from any proposed major facility or major modification which the Department, on a case-by-case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for the facility or modification through application of production processes or available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of the pollutant. The application of BACT may not result in emissions of a pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR Part 60 or 61. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. The standard must, to the degree possible, set forth the emissions reduction achievable by implementation of the design, equipment, work practice or operation, and provide for compliance by means which achieve equivalent results (25 PA Code 121.1).

BAT

Best Available Technology--Equipment, devices, methods or techniques as determined by the Department which will prevent, reduce or control emissions of

air contaminants to the maximum degree possible and which are available or may be made available (25 PA Code 121.1).

Biomass Industry

The production, distribution and consumption of an organic form of renewable energy that primarily uses organic waste such as wood, corn or switch grass as the source of fuel.

Environmental Justice:

The term environmental justice has been defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (PA DEP, 2011).

Fugitive Emissions:

For purposes of Chapter 127 (relating to construction, modification, reactivation and operation of sources), those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening (25 PA Code 121.1).

LEAR

Lowest Achievable Emission Rate; ((i) The rate of emissions based on the following, whichever is more stringent: (A) The most stringent emission limitation which is contained in the implementation plan of a state for the class or category of source unless the owner or operator of the proposed source demonstrates that the limitations are not achievable. (B) The most stringent emission limitation which is achieved in practice by the class or category of source. (ii) The

application of the term may not allow a new or proposed modified source to emit a pollutant in excess of the amount allowable under an applicable new source standard of performance (25 PA Code 121.1).

MACT

The Clean Air Act requires the EPA to promulgate regulations establishing emission standards for each category or subcategory of major sources and area sources of hazardous air pollutants. These regulations are called National Emission Standards for Hazardous Air Pollutants, or NESHAPS. The standards must require the maximum degree of emission reduction that the EPA determines to be achievable by each particular source category. These controls are referred to as Maximum Achievable Control Technology, or MACT (PA DEP, 2011).

Malodor:

An odor which causes annoyance or discomfort to the public and which the Department determines to be objectionable to the public (25 PA Code 121.1).

NESHAP

The Clean Air Act requires the EPA to promulgate regulations establishing emission standards for each category or subcategory of major sources and area sources of hazardous air pollutants. These regulations are called National Emission Standards for Hazardous Air Pollutants, or NESHAPS. The standards must require the maximum degree of emission reduction that the EPA determines to be achievable by each particular source category. These controls are referred to as Maximum Achievable Control Technology, or MACT (PA DEP, 2011).

NSPS

New Source Performance Standards (25 PA Code 121.1).

Non-attainment Area

An area designated by the EPA under section 107 of the Clean Air Act (42 U.S.C.A. § 7407) in 40 CFR 81.339 (relating to Pennsylvania) (25 PA Code 121.1).

Opacity:

The degree to which emissions reduce the transmission of light and obscure the view of an object in the background (25 PA Code 121.1).

Operating Permit

Before an owner/operator of a facility can begin to construct, modify or operate a source, emissions unit or equipment emitting air contaminants in Pennsylvania, the owner/operator needs to obtain prior written approval from the department's Air Quality Program. The process of obtaining an air permit generally consists of two steps. The first step is obtaining a pre-construction permit authorization, known as a Plan Approval, from the department. The Plan Approval allows the organization to begin construction, installation or modification at their facility. The second step is obtaining an Operating Permit to allow actual operations at the facility (PA DEP, 2011)

Particulate Matter (PM):

A material except uncombined water which is or has been airborne and exists as a solid or liquid at 70° F and 14.7 pounds per square inch absolute pressure (25 PA Code 121.1).

Particulate Matter 10 (PM10):

Particulate matter with an effective aerodynamic diameter of less than or equal to a nominal 10 micrometer body as measured by the applicable reference method or an equal method (25 PA Code 121.1).

Photosynthesis

Synthesis of chemical compounds with the aid of radiant energy and especially light; *especially* **:** formation of carbohydrates from carbon dioxide and a source of hydrogen (as water) in the chlorophyll-containing tissues of plants exposed to light (www.m-w.com, 2011).

Plan Approval

Before an owner/operator of a facility can begin to construct, modify or operate a source, emissions unit or equipment emitting air contaminants in Pennsylvania, the owner/operator needs to obtain prior written approval from the department's Air Quality Program. The process of obtaining an air permit generally consists of two steps. The first step is obtaining a pre-construction permit authorization, known as a Plan Approval, from the department. The Plan Approval allows the organization to begin construction, installation or modification at their facility. The second step is obtaining an Operating Permit to allow actual operations at the facility (PA DEP, 2011).

RFD

Request For Determination: Not all air contamination sources require a Plan Approval or operating permit; some may be exempt under commonwealth regulations, and some may be granted an exemption on a case-by-case basis. The process used to obtain a case-by-case exemption requires that a Request for

> *Determination (RFD) Form be submitted. The RFD Form is the mechanism by which the department evaluates a case-by-case exemption request. By submitting a completed RFD, a company, in essence, asks the department to make a judgment about whether the owner/operator must obtain a Plan Approval or Operating Permit and/or modify an existing Operating Permit in order to proceed with the proposed project. Under 25 Pa. Code § 127.14, among other criteria, if the air contamination sources being referenced are exempt based on the Air Quality Permit Exemption List (Document No. 275-2101-003) or if the department determines the sources to be of minor significance, a Plan Approval and/or Operating Permit will not be required.* (PA DEP, 2011).

Source:

> *An air contamination source* (25 PA Code 121.1).

Stationary Source:

> *Any building, structure, facility, or installation which emits or may emit any air pollutant* (40 CFR 60.2).

Testing:

Performance tests are generally not so much defined as described according to regulatory requirement and method, rule by rule. The generally accepted definition of a "stack test…or source test" follows:

> *A stack test, also referred to in EPA regulations as a performance or source test, measures the amount of a specific regulated pollutant, pollutants, or surrogates being emitted; demonstrates the capture efficiency of a capture system; or determines the destruction or removal efficiency of a control device used to reduce emissions at facilities subject to the requirements of the Clean Air Act*

(CAA or Act). Stack testing is an important tool used to determine a facility's compliance with emission limits, or capture or control efficiencies established pursuant to the CAA. (EPA National Stack Testing Guidance 4/27/2009).

LIST OF FIGURES

Figure 10. Solar and Heat Energy Cycle Doyle, B., EPA Combustion Source Evaluation APTI Student Manual 3rd Edition.

Table 1: Citation of State and Federal Regulations

Law or Regulation	Citation
Code of Federal Regulations	Title 40 Protection of Environment
Small Business Definition	13 CFR 121.201
Exempt VOC List	40 CFR 51.100
Prevention of Significant Deterioration (PSD)	40 CFR Part 52
New Source Performance Standards (NSPS)	40 CFR Part 60
New Source Performance Standards (NSPS)	40 CFR Part 60b
New Source Performance Standards (NSPS)	40 CFR Part 60c
New Source Performance Standards (NSPS)	40 CFR Part 60D thru Dc
National Emission Standards for Hazardous Air Pollutants (NESHAPS)	40 CFR Part 61
Maximum Achievable Control Technology (MACT)	40 CFR Part 63
The Pennsylvania Code	Title 25 Environmental Protection
The Pennsylvania Code: Definitions	25 PA Code 121.1
The Pennsylvania Code: Prohibition of air pollution	25 PA Code 121.7
The Pennsylvania Code: Prohibition of certain fugitive emissions	25 PA Code 123.1
The Pennsylvania Code: Combustion units	25 PA Code 123.11
The Pennsylvania Code: Odor emissions	25 PA Code 123.31
The Pennsylvania Code: Visible emissions	25 PA Code 123.41
The Pennsylvania Code: Plan approval requirements	25 PA Code 127.11
The Pennsylvania Code: Municipal notification	25 PA Code 127.43a
Pennsylvania Air Pollution Control Act: Small Business Compliance Assistance Program	Section 7.7
Pennsylvania Air Pollution Control Act: Compliance Advisory Committee	Section 7.8
Pennsylvania Air Pollution Control Act: Small Business Ombudsman	Section 7.9

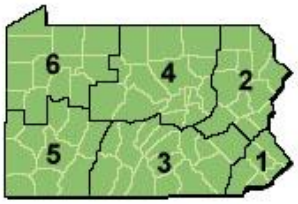
APPENDIX A: Biomass Project Checklist

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
What is the proposed biomass feedstock and can it be acquired locally?	□	□	□	□	_____
Has the cost of transportation been considered?	□	□	□	□	_____
Will the biomass project involve supplying energy and if so, who will be the consumers?	□	□	□	□	_____
Other?	_____				
Have similar permits for biomass projects been reviewed?	□	□	□	□	_____
Have local elected officials and other community leaders been contacted?	□	□	□	□	_____
Have any local citizens involved in volunteer groups or environmental advocacy groups been contacted?	□	□	□	□	_____
Other?	_____				
Does the biomass project have a strategy to address corporate social responsibility?	□	□	□	□	_____
What metrics will be used to validate the biomass project?	□	□	□	□	_____
Other?	_____				
What is the primary biomass fuel source?	□	□	□	□	_____
Are acceptable emission factors for the biomass project found in AP-42?	□	□	□	□	_____
Other?	_____				
Have sufficient plans been made to acquire all necessary permits and approvals from PA DEP?	□	□	□	□	_____
Has the necessary technical information been acquired from all vendors for evaluation in relation to the Pennsylvania regulations?	□	□	□	□	_____
Has an air quality control device been chosen and will it meet the "grain loading" standard?	□	□	□	□	_____
Is there a plan to manage any potential odor issues?	□	□	□	□	_____
Is there a plan to manage any potential opacity issues?	□	□	□	□	_____

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
Is there a plan to manage any potential fugitive emissions?	□	□	□	□	_____
Are finances available if required to conduct a stack test?	□	□	□	□	_____
Is there a plan to manage the air quality plan approval or permit once issued?	□	□	□	□	_____
What air pollution-related activities are regulated for the project?	□	□	□	□	_____
Which regulations or regulators are relevant, and what key air pollution regulatory requirements might apply to certain operations?	□	□	□	□	_____
Has the physical site location been chosen?	□	□	□	□	_____
Other?	_____				
Is the biomass combustion unit rated greater than 2.5 mmbtu/hr?	□	□	□	□	_____
Have emission estimates been prepared?	□	□	□	□	_____
Is an air quality plan approval application complete?	□	□	□	□	_____
Has general information form (GIF) been completed?	□	□	□	□	_____
Has a compliance review form been completed?	□	□	□	□	_____
Has a municipal notification been prepared and if so, is there proof?	□	□	□	□	_____
Other?	_____				
Has multiple people been designated to share in and support the environmental responsibilities for the biomass project?	□	□	□	□	_____
Have the proper records and operating parameters to be monitored been identified?	□	□	□	□	_____
Have all of the checklists in this guide been completed?	□	□	□	□	_____
Other?	_____				
Is it known in which PA DEP Region the biomass project will be located?	□	□	□	□	_____

Biomass Project Checklist:	Yes	No	N/A	Need assistance	Other
Has the Small Business Ombudsman's Office been contacted for assistance?	□	□	□	□	_____
Has EMAP been contacted for assistance?	□	□	□	□	_____
Have preparations been made for a pre-application meeting with PA DEP?	□	□	□	□	_____
Other?	_____				
Has EPA's Mid-Atlantic Regional Office been contacted for assistance?	□	□	□	□	_____
Has the Combined Heat and Power partnership been contacted for assistance?	□	□	□	□	_____
Does the NSPS standards apply to the biomass project?	□	□	□	□	_____
Will the biomass combustion unit have a heat input capacity exceeding 100 MMBTU/hr?	□	□	□	□	_____
Other?	_____				

APPENDIX B: Pennsylvania Bureau of Air Quality regional offices and local Air Quality programs and agencies approved under the Federal Clean Air Act and State Implementation Plan



Region 1
Southeast Regional Office
2 East Main Street
Norristown, Pa 19401
(484) 250-5920
Counties: Bucks, Chester, Delaware, Montgomery, Philadelphia

Region 2
Northeast Regional Office
2 Public Square
Wilkesbarre, Pa 18711
(570) 826-2435
Counties: Carbon, Lackawanna, Lehigh, Luzerne, Monroe, Northampton, Pike, Schuylkill, Susquehanna, Wayne, Wyoming

Region 3
Southcentral Regional Office
909 Elmerton Avenue
Harrisburg, Pa 17110
(717) 705-4702
Counties: Adams, Bedford, Berks, Blair, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Mifflin, Perry, York

Air Management Services
321 University Avenue
Philadelphia, Pa 19104
(215) 685-7585
Philadelphia County

Region 4
Northcentral Regional Office
208 West Third Street
Williamsport, Pa 17701
(570) 327-3648
Counties; Bradford, Cameron, Centre, Clearfield, Clinton, Columbia, Lycoming, Montour, Northumberland, Potter, Snyder, Sullivan, Tioga, Union

Region 5
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, Pa 15222
(412) 442-4161
Counties: Allegheny, Armstrong, Beaver, Cambria, Fayette, Green, Indiana, Somerset, Washington, Westmoreland

Region 6
Northwest Regional Office
230 Chestnut Street
Meadville, Pa 16335
(814) 332-6125
Counties: Butler, Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, Mckean, Mercer, Venango, Warren

Allegheny County Health Dept.
3901 Penn Avenue Building 7
Pittsburgh, Pa 15201
(412) 578-8103
Allegheny County

APPENDIX C: EPA Regional Offices

Region 1 (CT, MA, ME, NH, RI, VT)
Environmental Protection Agency
5 Post Office Square - Suite 100
Boston, MA 02109-3912
Phone: (617) 918-1111
Fax: (617) 918-1809
Toll free within Region 1: (888) 372-7341

Region 2 (NJ, NY, PR, VI)
Environmental Protection Agency
290 Broadway
New York, NY 10007-1866
Phone: (212) 637-3000
Fax: (212) 637-3526

Region 3 (DC, DE, MD, PA, VA, WV)
Environmental Protection Agency
1650 Arch Street
Philadelphia, PA 19103-2029
Phone: (215) 814-5000
Fax: (215) 814-5103
Toll free: (800) 438-2474
Email: r3public@epa.gov

Region 4 (AL, FL, GA, KY, MS, NC, SC, TN)
Environmental Protection Agency
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303-3104
Phone: (404) 562-9900
Fax: (404) 562-8174
Toll free: (800) 241-1754

Region 5 (IL, IN, MI, MN, OH, WI)
Environmental Protection Agency
77 West Jackson Boulevard
Chicago, IL 60604-3507
Phone: (312) 353-2000
Fax: (312) 353-4135
Toll free within Region 5: (800) 621-8431

Region 6 (AR, LA, NM, OK, TX)
Environmental Protection Agency
Fountain Place 12th Floor, Suite 1200
1445 Ross Avenue
Dallas, TX 75202-2733
Phone: (214) 665-2200
Toll free within Region 6: (800) 887-6063

Region 7 (IA, KS, MO, NE)
Environmental Protection Agency
901 North 5th Street
Kansas City, KS 66101
Phone: (913) 551-7003
Toll free: (800) 223-0425

Region 8 (CO, MT, ND, SD, UT, WY)
Environmental Protection Agency
1595 Wynkoop St.
Denver, CO 80202-1129
Phone: (303) 312-6312
Fax: (303) 312-6339
Toll free: (800) 227-8917
Email: r8eisc@epa.gov

Region 9 (AZ, CA, HI, NV)
Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105
Phone: (415) 947-8000
(866) EPA-WEST (toll free in Region 9)
Fax: (415) 947-3553
Email: r9.info@epa.gov

Region 10 (AK, ID, OR, WA)
Environmental Protection Agency
1200 Sixth Avenue, Suite 900
Seattle, WA 98101
Phone: (206) 553-1200
Fax: (206) 553-2955Tollfree:(800)424-4372

APPENDIX D: Example Calculations

Biomass Burner rated @ 10 MMBTU/HR
PTE Emission estimates based on 8,760 hours / year.
Operated on wood scrap (dry wood) only

Filterable PM estimates w/ No control				
AP-42 Emission Factor (Table 1.6-1) =	0.40	lb/MMBTU		
10.0 MMBTUH* 0.40 lb/MMBTU * 8760 hours =			35,040	lb/yr
			17.52	tpy
Filterable PM-10 estimates w/ No control				
AP-42 Emission Factor (Table 1.6-1) =	0.36	lb/MMBTU		
10.0 MMBTUH* 0.36 lb/MMBTU * 8760 hours =			31,536	lb/yr
			15.768	tpy
Filterable PM 2.5 estimates w/ No control				
AP-42 Emission Factor (Table 1.6-1) =	0.31	lb/MMBTU		
10.0 MMBTUH* 0.31 lb/MMBTU * 8760 hours =			27,156	lb/yr
			13.578	tpy

NOx estimates w/ No control				
AP-42 Emission Factor (Table 1.6-2) =	0.49	lb/MMBTU		
10.0 MMBTUH* 0.49 lb/MMBTU * 8760 hours =			42924	lb/yr
			21.462	tpy
CO estimates w/ No Control				
AP-42 Emission Factor (Table 1.6-2) =	0.6	lb/MMBTU		
10.0 MMBTUH* 0.60 lb/MMBTU * 8760 hours =			52560	lb/yr
			26.28	tpy
SOx estimates w/ No control				
AP-42 Emission Factor (Table 1.6-2) =	0.03	lb/MMBTU		
10.0 MMBTUH* 0.025 lb/MMBTU * 8760 hours =			2190	lb/yr
			1.095	tpy
VOC estimates w/ No Control				
AP-42 Emission Factor (Table 1.6-3) =	0.02	lb/MMBTU		
10.0 MMBTUH* 0.017lb/MMBTU * 8760 hours =			1489.2	lb/yr
			0.7446	tpy

Filterable PM estimates w/ Mechanical Collector				
AP-42 Emission Factor (Table 1.6-1) =	0.30	lb/MMBTU		
10.0 MMBTUH*0.30 lb/MMBTU * 8760 hours =			26280	lb/yr
			13.14	tpy
Filterable PM-10 estimates w/ Mechanical Control				
AP-42 Emission Factor (Table 1.6-1) =	0.27	lb/MMBTU		
10.0 MMBTUH* 0.27 lb/MMBTU * 8760 hours =			23652	lb/yr
			11.826	tpy
Filterable PM 2.5 estimates w/ Mechanical Control				
AP-42 Emission Factor (Table 1.6-1) =	0.16	lb/MMBTU		
10.0 MMBTUH* 0.16 lb/MMBTU * 8760 hours =			14016	lb/yr
			7.008	tpy

Filterable PM estimates w/ Electrostatic Precipitator				
AP-42 Emission Factor (Table 1.6-1) =	0.054	lb/MMBTU		
10.0 MMBTUH* 0.30 lb/MMBTU * 8760 hours =			4730.4	lb/yr
			2.3652	tpy
Filterable PM-10 estimates w/ Electrostatic Precipitator				
AP-42 Emission Factor (Table 1.6-1) =	0.04	lb/MMBTU		
10.0 MMBTUH* 0.27 lb/MMBTU * 8760 hours =			3504	lb/yr
			1.752	tpy
Filterable PM 2.5 estimates w/ Electrostatic Precipitator				
AP-42 Emission Factor (Table 1.6-1) =	0.035	lb/MMBTU		
10.0 MMBTUH* 0.16 lb/MMBTU * 8760 hours =			3066	lb/yr
			1.533	tpy

Filterable PM estimates w/ Wet Scrubber				
AP-42 Emission Factor (Table 1.6-1) =		0.066	lb/MMBTU	
10.0 MMBTUH* 0.066 lb/MMBTU * 8760 hours =			5781.6	lb/yr
			2.8908	tpy
Filterable PM-10 estimates w/ Wet Scrubber				
AP-42 Emission Factor (Table 1.6-1) =		0.065	lb/MMBTU	
10.0 MMBTUH* 0.065 lb/MMBTU * 8760 hours =			5694	lb/yr
			2.847	tpy
Filterable PM 2.5 estimates w/ Wet Scrubber				
AP-42 Emission Factor (Table 1.6-1) =		0.065	lb/MMBTU	
10.0 MMBTUH* 0.065 lb/MMBTU * 8760 hours =			5694	lb/yr
			2.847	tpy

Filterable PM estimates w/ Fabric Filter				
AP-42 Emission Factor (Table 1.6-1) =		0.1	lb/MMBTU	
10.0 MMBTUH* 0.30 lb/MMBTU * 8760 hours =			8760	lb/yr
			4.38	tpy
Filterable PM-10 estimates w/ Fabric Filter				
AP-42 Emission Factor (Table 1.6-1) =		0.074	lb/MMBTU	
10.0 MMBTUH* 0.27 lb/MMBTU * 8760 hours =			6482.4	lb/yr
			3.2412	tpy
Filterable PM 2.5 estimates w/ Fabric Filter				
AP-42 Emission Factor (Table 1.6-1) =		0.065	lb/MMBTU	
10.0 MMBTUH* 0.16 lb/MMBTU * 8760 hours =			5694	lb/yr
			2.847	tpy

Biomass Burner rated @ 10 MMBTU/HR

PTE Emission estimates based on 8,760 hours / year.
Operated on wood scrap (dry wood) only

CHAPTER 123.13 (c) (1) (i) PM EMISSION LIMITITATION CALCULATION (w/ Control)

Annual PM pounds	30,660	52	weeks/year		
Weekly PM pounds	590		7000	gr/dscf	
Days / Week	7				
Pounds / Day	84.23				
Hours / Day	24				
Effluent SCFM	11,196	*			
Effluent ACFM	18,000		Standard (25 PA 123.13) =	0.04	gr/dscf

PM Conc. (gr/ft^3) = (84.23 lb/day * 7,000 gr/lb)/(11,196 SCFM * 60min/hr * 24 hr/day) = 0.037 gr/dscf

*ACFM to SCFM Conversion

		Value	Correction Factor	SCFM=	ACFM/ (Ct*Ch*Ce)
Temperature	Ct	180° F	1.21	=	11196.18
Humidity	Ch	0.337	1.295		
Elevation	Ce	650 ft	1.026		

APPENDIX E: Emission Limits for Major Source Boilers

Emission Limits for Major Source Boilers

Subcategory	Proposed limits, lb/MMBtu unless noted					Final limits, lb/MMBtu unless noted				
	Hg, lb/TBtu	HCl	PM	CO, ppm	D/F, ng/dscm	Hg, lb/TBtu	HCl	PM	CO, ppm	D/F, ng/dscm
New coal stoker	2.0	0.00006	0.001	7	0.003	3.5	0.0022	0.0011	6	0.003
New coal fluid. bed				30	0.00003	Solid fuel subcat.	Solid fuel subcat.	Solid fuel subcat.	18	0.002
New coal PC				90	0.002				12	0.003
New biomass stoker	0.2	0.004	0.008	560	0.00005				160	0.005
New biomass fuel cell				270	0.0005				470	0.003
New biomass fluid. bed				40	0.007				260	0.02
New biomass dutch oven				1,010	0.03				470	0.2
New biomass susp./grate	--	--	--	--	--				1,500	0.2
New liquid	0.3	0.0004	0.002	1	0.002	0.21	0.00032	0.0013	3	0.002
New gas 2	0.2	0.000003	0.003	1	0.009	7.9	0.0017	0.0067	3	0.08
New non-cont. liquid	--	--	--	--	--	0.78	0.00032	0.0013	51	0.002
Exist. coal stoker	3.0	0.02	0.02	50	0.003	4.6	0.035	0.039	270	0.003
Exist. coal fluid. Bed				30	0.002	Solid fuel subcat.	Solid fuel subcat.	Solid fuel subcat.	82	0.002
Exist. coal PC				90	0.004				160	0.004
Exist. biomass stoker	0.9	0.006	0.02	560	0.004				490	0.005
Exist. biomass fuel cell				270	0.02				690	4
Exist. biomass fluid. bed				250	0.02				430	0.02
Exist. biomass dutch oven				1,010	0.03				470	0.2
Exist. biomass sus./grate	--	--	--	--	--				3,500	0.2
Exist. liquid	4.0	0.0009	0.004	1	0.002	3.4	0.00032	0.0075	10	4
Exist. gas 2	0.2	0.000003	0.05	1	0.009	13	0.0017	0.043	9.0	0.08
Exist. non-cont. liquid	--	--	--	--	--	0.78	0.00032	0.0075	160	4

New and existing small (<10 MMBtu/hr) units, natural gas-fired units, metal process furnaces, units combusting other clean gases, and limited use units will be subject to work practice standards.

APPENDIX F: Emission Limits for Area Source Boilers

Emission Limits for Area Source Boilers

Subcategory	Proposed Emission Limits			Final Emission Limits		
	Hg, lb/TBtu	CO, ppm	PM, lb/MMBtu	Hg, lb/TBtu	CO, ppm	PM, lb/MMBtu
New Coal	3.0	310	0.03	4.8	400	0.03 (> 30 MMBtu/h) 0.42 (10 to 30 MMBtu/h)
New Biomass	-	100	0.03	-	-	0.03 (> 30 MMBtu/h) 0.07 (10 to 30 MMBtu/h)
New Oil	-	1	0.03	-	-	0.03
Existing Coal	3.0	310	-	4.8	400	-
Existing Biomass	-	160	-	-	-	-
Existing Oil	-	2	-	-	-	-

New and existing small (<10 MMBtu/hr) boiler, existing and new biomass-fired boilers, and new and existing oil-fired boilers are subject to a biennial tune-up requirement.

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